

# Software Engineering Program

College of Engineering & Advance Computing, Alfaisal University

*Effective: Fall 2024*

## Curriculum Structure and Study Plan

The Software Engineering curriculum is composed of **133** Credit Hours (CRHs) divided as follows:

### I. General Education Requirements (44 CRHs)

1. Mathematics & Statistics (15 CRHs)
2. Basic Sciences (12 CRHs)
3. Humanities (17 CRHs)

### II. Core Requirements (89 CRHs)

1. Software Engineering Courses (69 CRHs)
2. College of Engineering Courses (8 CRHs)
3. Technical Electives (12 CRHs)
4. Summer Internship (0 CRHs)

<b>I. General Education Requirements (44 CRHs)</b>
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#### 1. Mathematics & Statistics (15 CRHs)

Course Code	Course-Title	Credit Hours (CRHs)				Pre-Requisite Course Code	Co-Requisite Course Code
		Total-CRHs	Lect.	Lab	Tut		
MAT 101	Calculus I	3	3	0	2		
MAT 112	Calculus II	3	3	0	2	MAT 101	
MAT 212	Linear Algebra	3	3	0	0	MAT 112	
MAT 224	Numerical Methods	3	3	0	0	MAT 212, or equivalent	
STA 212	Probability and Statistics for Engineers	3	3	0	0	MAT 112	

**2. Basic Sciences (12 CRHs)**

Course Code	Course-Title	Credit Hours (CRHs)				Pre-Requisite Course Code	Co-Requisite Course Code
		Total-CRHs	Lect	Lab	Tut		
CHM 102	Introduction to Chemistry	3	3	0	1		
CHM 102 L	Introduction to Chemistry Lab	1	0	2	0		CHEM 102
PHU 103	Mechanics and Waves for Engineers	3	3	0	1		MAT 101
PHU 103 L	Mechanics and Waves for Engineers Lab	1	0	2	0		PHU 103
PHU 124	Electromagnetism and Optics for Engineers	3	3	0	1	PHU 103 & MAT 101	
PHU 124 L	Electromagnetism and Optics for Engineers Lab	1	0	2	0	PHU 103 & MAT 101	PHU 124

**3. Humanities (17 CRHs)**

Course Code	Course-Title	Credit Hours (CRHs)				Pre-Requisite Course Code	Co-Requisite Course Code
		Total-CRHs	Lect	Lab	Tut		
ENG 101	University Writing	3	3	0	0		
-----	General Education Elective I	2	2	0	0		
ENG 222	Technical Writing	3	3	0	0	ENG 101	
ISL 101	Islamic Studies I	2	2	0	0		
ARB 101	Arabic Language I	2	2	0	0		
-----	General Education Elective	2	2	0	0	ARB 101	
ENG ___	English Elective	3	3	0	0		

**II. Core Requirements (89 CRHs)**
**1. Software Engineering Courses (69 CRHs)**

Course Code	Course-Title	Credit Hours (CRHs)				Pre-Requisite Course Code	Co-Requisite Course Code
		Tot al-CR Hs	Lect	Lab	Tut		
SE 100	Programming for Engineers	3	3	0	0		
SE 100 L	Programming for Engineers Lab	1	0	2	0		SE 100
SE 117	Software Practice and Society	3	3	0	0		
SE 120	Object-Oriented Programming I	3	3	0	0	SE 100	
SE 120 L	Object-Oriented Programming I Lab	1	0	2	0	SE 100	SE 120
SE 201	Introduction to Software Engineering	3	3	0	0	SE 120	
SE 212	Discrete Structures for Software Engineers	3	3	0	0	SE 120	
SE 214	Algorithms and Data Structures	3	3	0	0	SE 120	
SE 214 L	Algorithms and Data Structures Lab	1	0	2	0	SE 120	SE 214
SE 220	Object-Oriented Programming II	3	0	0	0	SE 120	
SE 220 L	Object-Oriented Programming II Lab	1	0	2	0	SE 120	SE 220
SE 225	Software Requirements	3	3	0	0	SE 201	
SE 225 L	Software Requirements Lab	1	0	2	0	SE 201	SE 225
SE 310	Software Design and Architecture	3	3	0	0	SE 225	
SE 312	Database Management Systems	3	3	0	0	SE 214	
SE 312 L	Database Management Systems Lab	1	0	2	0	SE 214	SE 312

SE 314	Operating Systems	3	3	0	0	SE 214	
SE 314 L	Operating Systems Lab	1	0	2	0	SE 214	SE 314
SE 322	Internet of Things Application Development	3	3	0	0	SE 100, EE 305	
SE 324	Web Application Development	3	3	0	0	SE 312	
SE 324 L	Web Application Development Lab	1	0	2	0	SE 312	SE 324
SE 328	Mobile Application Design and Development	3	3	0	0	SE 225, SE 312	
SE 328 L	Mobile Application Design and Development Lab	1	0	2	0	SE 225, SE 312	SE 328
SE 330	Introduction to Cybersecurity	3	3	0	0	SE 305	
SE 412	Software Testing and Quality Assurance	3	3	0	0	SE 310	
SE 414	Software Project Management	3	3	0	0	SE 310	
SE 423	Software Construction and Processes	3	3	0	0	SE 412	
SE 495	Software Engineering Capstone Project I	3	0	6	0	SE 310, SE 324	
SE 496	Software Engineering Capstone Project II	3	0	6	0	SE 495	

### 2. College of Engineering Courses (8 CRHs)

Course Code	Course-Title	Credit Hours (CRHs)				Pre-Requisite Course Code	Co-Requisite Course Code
		Total-CRHs	Lect	Lab	Tut		
EE 210	Digital Logic Design	3	0	0	0	PHU 124	
EE 210 L	Digital Logic Design Lab	1	0	2	0	PHU 124	EE 210
EE 305	Computer Networks	3	3	0	0	SE 100, EE 210, STAT 212	
EE 305 L	Computer Networks Lab	1	0	2	0	SE 100, EE 210, STAT 212	EE 305

### 3. Technical Electives (12 CRHs)

Select from the following courses:

Course Code	Course-Title	Credit Hours (CRHs)				Pre-Requisite Course Code	Co-Requisite Course Code
		Total-CRHs	Lect	Lab	Tut		
SE 435	Undergraduate Research in Software Engineering	3	0	6	0	Department Chair approval. A GPA of at least 3.7/4.0, and a signed research contract	
SE 440	Special Topics in Software Engineering	3	3	0	0	SE 324	
SE 441	Telecommunications Software Design	3	3	0	0	EE 305	
SE 442	Social Networks for Software Engineers	3	3	0	0	SE 324	
SE 443	Cloud Computing for Software Engineers	3	3	0	0	SE 324, EE 305	
SE 444	Artificial Intelligence	3	3	0	0	SE 214, SE 324	
SE 445	Information and Software Security	3	3	0	0	STA 212, SE 324	
SE 446	Introduction to Big Data	3	3	0	0	SE 312, SE 314	
SE 447	Introduction to Machine Learning	3	3	0	0	SE 312, SE 314	
SE 448	Blockchain Development	3	3	0	0	SE 324	
SE 449	Data Analytics	3	3	0	0	SE 312, SE 314	
SE 450	Cryptography and Data Privacy	3	3	0	0	STA 212, SE 330	
SE 451	Secure Software Engineering	3	3	0	0	SE 310, SE 330	
SE 452	Network Security	3	3	0	0	EE 305, SE 330	
SE 453	Security Risk Management & Control	3	3	0	0	SE 330	
SE 454	Ethical Hacking and Systems Defense	3	3	0	0	SE 330, SE 452	

### 4. Summer Internship (0 CRHs)

Course Code	Course-Title	Credit Hours (CRHs)	Pre-Requisite Course Code	Co-Requisite Course Code
<b>SE 390</b>	<b>Software Engineering Summer Internship</b>	<b>0</b>	<b>101 CRHs passed and department approval</b>	

**Typical Study Plan-Software Engineering Program**

**4-Year Curriculum: 133 Credit Hours Total**

Each course below follows the following format:

Course code, Course Title, and Course Credit Hours (Lecture contact hours – Lab contact hours – Tutorial contact hours)

<i>1<sup>st</sup> Year</i>			
Fall	Course Code	Course-Title	CRHs
	<b>SE 100</b>	<b>Programming for Engineers</b>	<b>3 (3-0-0)</b>
	<b>SE 100 L</b>	<b>Programming for Engineers Lab</b>	<b>1 (0-2-0)</b>
	<b>SE 117</b>	<b>Software Practice and Society</b>	<b>3 (3-0-0)</b>
	<b>MAT 101</b>	<b>Calculus I</b>	<b>3 (3-0-2)</b>
	<b>PHU 103</b>	<b>Mechanics and Waves for Engineers</b>	<b>3 (3-0-1)</b>
	<b>PHU 103 L</b>	<b>Mechanics and Waves for Engineers Lab</b>	<b>1 (0-2-0)</b>
	<b>ENG 101</b>	<b>University Writing</b>	<b>3 (3-0-0)</b>
<b>Total</b>			<b>17</b>
Spring	Course Code	Course-Title	CRHs
	<b>SE 120</b>	<b>Object-Oriented Programming I</b>	<b>3 (3-0-0)</b>
	<b>SE 120 L</b>	<b>Object-Oriented Programming I Lab</b>	<b>1 (0-2-0)</b>
	<b>CHM 102</b>	<b>Introduction to Chemistry</b>	<b>3 (3-0-0)</b>
	<b>CHM 102 L</b>	<b>Introduction to Chemistry Lab</b>	<b>1 (1-0-0)</b>
	<b>MAT 112</b>	<b>Calculus II</b>	<b>3 (3-0-2)</b>
	<b>PHU 124</b>	<b>Electromagnetism and Optics for Engineers</b>	<b>3 (3-0-1)</b>
	<b>PHU 124 L</b>	<b>Electromagnetism and Optics for Engineers Lab</b>	<b>1 (0-2-0)</b>
	<b>ARB 101</b>	<b>Arabic Language I</b>	<b>2 (2-0-0)</b>
<b>Total</b>			<b>17</b>



<i>2<sup>nd</sup> Year</i>			
Fall	Course Code	Course-Title	CRHs
	<b>SE 201</b>	<b>Introduction to Software Engineering</b>	<b>3 (3-0-0)</b>
	<b>SE 214</b>	<b>Algorithms and Data Structures</b>	<b>3 (3-0-0)</b>
	<b>SE 214 L</b>	<b>Algorithms and Data Structures Lab</b>	<b>1 (0-2-0)</b>
	<b>SE 220</b>	<b>Object-Oriented Programming II</b>	<b>3 (3-0-0)</b>
	<b>SE 220 L</b>	<b>Object-Oriented Programming II L</b>	<b>1 (0-2-0)</b>
	<b>MAT 212</b>	<b>Linear Algebra</b>	<b>3 (3-0-0)</b>
	<b>ISL 101</b>	<b>Islamic Studies I</b>	<b>2 (2-0-0)</b>
<b>Total</b>			<b>16</b>
Spring	Course Code	Course-Title	CRHs
	<b>SE 212</b>	<b>Discrete Structure for Software Engineers</b>	<b>3 (3-0-0)</b>
	<b>SE 225</b>	<b>Software Requirements</b>	<b>3 (3-0-0)</b>
	<b>SE 225 L</b>	<b>Software Requirements Lab</b>	<b>1 (0-2-0)</b>
	<b>EE 210</b>	<b>Digital Logic Design</b>	<b>3 (3-0-0)</b>
	<b>EE 210 L</b>	<b>Digital Logic Design Lab</b>	<b>1 (0-2-0)</b>
	<b>MAT 224</b>	<b>Numerical Methods</b>	<b>3 (3-0-0)</b>
	<b>STA 212</b>	<b>Probability and Statistics for Engineers</b>	<b>3 (3-0-0)</b>
<b>Total</b>			<b>17</b>

<b>3<sup>rd</sup> Year</b>			
Fall	Course Code	Course-Title	CRHs
	<b>SE 310</b>	<b>Software Design and Architecture</b>	<b>3 (3-0-0)</b>
	<b>SE 312</b>	<b>Database Management Systems</b>	<b>3 (3-0-0)</b>
	<b>SE 312 L</b>	<b>Database Management Systems Lab</b>	<b>1 (0-2-0)</b>
	<b>SE 314</b>	<b>Operating Systems</b>	<b>3 (3-0-0)</b>
	<b>SE 314L</b>	<b>Operating Systems Lab</b>	<b>1 (0-2-0)</b>
	<b>EE 305</b>	<b>Computer Networks</b>	<b>3 (3-0-0)</b>
	<b>EE 305 L</b>	<b>Computer Networks Lab</b>	<b>1 (0-2-0)</b>
	<b>ENG ___</b>	<b>English Elective</b>	<b>3 (3-0-0)</b>
<b>Total</b>			<b>17</b>
Spring	Course Code	Course-Title	CRHs
	<b>SE 322</b>	<b>Internet of Things Application Development</b>	<b>3 (3-0-0)</b>
	<b>SE 324</b>	<b>Web Application Development</b>	<b>3 (3-0-0)</b>
	<b>SE 324L</b>	<b>Web Application Development Lab</b>	<b>1 (0-2-0)</b>
	<b>SE 328</b>	<b>Mobile Application Development</b>	<b>3 (3-0-0)</b>
	<b>SE 328L</b>	<b>Mobile Application Development Lab</b>	<b>1 (0-2-0)</b>
	<b>SE 330</b>	<b>Introduction to Cybersecurity</b>	<b>3 (3-0-0)</b>
	<b>ENG 222</b>	<b>Technical Writing</b>	<b>3 (3-0-0)</b>
<b>Total</b>			<b>17</b>

Summer	Course Code	Course-Title	CRHs
	<b>SE 390</b>	<b>Software Engineering Summer Internship</b>	<b>0</b>
<b>Total</b>			<b>0</b>

**4<sup>th</sup> Year**

<b>4<sup>th</sup> Year</b>			
Fall	Course Code	Course-Title	CRHs
	SE 412	Software Testing & Quality Assurance	3 (3-0-0)
	SE 414	Software Project Management	3 (3-0-0)
	SE 4_ _	Technical Elective	3 (3-0-0)
	SE 4_ _	Technical Elective	3 (3-0-0)
	SE 495	Software Engineering Capstone Project I	3 (0-6-0)
	-----	General Education Elective I	2 (2-0-0)
<b>Total</b>			<b>17</b>
Spring	Course Code	Course-Title	CRHs
	SE 423	Software Construction and Processes	3 (3-0-0)
	SE 4_ _	Technical Elective	3 (3-0-0)
	SE 4_ _	Technical Elective	3 (3-0-0)
	SE 496	Software Engineering Capstone Project II	3 (0-6-0)
	-----	General Education Elective II	2 (2-0-0)
<b>Total</b>			<b>14</b>

## Software Engineering – Tracks

### **Bachelor of Science in Software Engineering – Game Development and Digital Media Track**

Game design is a combination of art, craft, and science. By designing, creating, and evaluating games, students in the Game Development and Digital Media Track will become experts in all three aspects. Students in this track learn the conceptual, aesthetic, and technical aspects of game creation that serve as a foundation for game design. This track provides a foundation in game design and software development principles. Students develop core competencies, collaborate on the design and development of game projects, and engage in authentic, situated, creative problem-solving to broaden their horizons as interdisciplinary team members.

### **Track Course Requirements (12 CRHs):**

**The following are the core courses required in the Game Development and Digital Media Track:**

- SE 461 – Game Engine Architecture and Implementation (Prerequisites: SE328)
- SE 462 – Fundamentals of Game Design (Prerequisite: SE 310)
- SE 463 – Game Mechanics, Prototyping, and Production (Prerequisite: SE 412)
- SE 464 – Innovative Topics in Immersive Game Development (Prerequisite: SE 324)

### **Bachelor of Science in Software Engineering – AI & Big Data Track**

The world is growing at an exponential rate and so is the size of the data collected across the globe. Current and future sources of data are devices which utilize the Internet of Things (IoT) technology in addition to social networks and business applications. Big data infrastructure and analytics are emerging as key concepts to sorting, managing analyzing this massive amount of generated data from connected objects and applications which helps to take the initiative to improve decision making. Thus, data is becoming more meaningful and contextually relevant, breaking new grounds for new computing concepts such as Machine Learning (ML) and Artificial Intelligence (AI). These concepts will introduce a new approach to shift the traditional computing concepts related to data from just collecting structured data to understanding it, to turning this massive amount of data into knowledge, conclusions, and intelligent actions.

In this track, students will be able to study new emerging technologies in the area of Artificial Intelligence and Big Data. Students enrolled in the Software Engineering program are eligible to register in this track.

### **Track Course Requirements (15 CRHs):**

**The following are the core courses required in the AI and Big Data track:**

- SE 322 – Internet of Things Application Development (Prerequisite(s): SE 100, EE 305)
- SE 444 – Artificial Intelligence (Prerequisite(s): SE 214, SE 324)
- SE 446 – Introduction to Big Data (Prerequisite(s): SE 312, SE 314)
- SE 447 – Introduction to Machine Learning (Prerequisite(s): SE 312, SE 314)

**One additional course may be taken from the following list of track electives:**

- SE 440 - Special Topics in Software Engineering (Prerequisite(s): SE 324)
- SE 443 – Cloud Computing for Software Engineers (Prerequisite(s): SE 324, EE 305)
- SE 448 – Blockchain Development (Prerequisite(s): SE 324)
- SE 450 – Cryptography and Data Privacy (Prerequisite(s): STA 212, SE 330)
- SE 451 – Secure Software Engineering (Prerequisite(s): SE 310, SE 330)
- SE 452 – Network Security (Prerequisite(s): EE 305, SE 330)
- SE 453 – Security Risk Management & Control (Prerequisite(s): SE 330)
- SE 454 – Ethical Hacking and Systems Defense (Prerequisite(s): SE 330, SE 452)

### **Bachelor of Software Engineering – Cybersecurity Track**

Security is a forefront concern for software vendors and customers and an indispensable quality attribute of software given the high level of interconnectivity of systems running critical software functions and storing confidential data. There is a multitude of attacks that attempt to exploit software systems to gain illegitimate access to functionalities and data. Despite the continuous exposure to threat, software systems cannot simply cease operations as a countermeasure and they are expected to be available and deliver business value to its stakeholders reliably. The Software Engineering Department, part of the College of Engineering at Alfaisal University has approved a cybersecurity track. This track will equip students with the necessary skills and respond to challenges in cybersecurity, data privacy, network security, socio-technical issues in addition to learning how to develop secure systems by practicing proper secure software engineering principles. Students in the Bachelor of Software Engineering program at Alfaisal University are eligible to opt for this track.

#### **Track Course Requirements (15 CRHs):**

**The following are the core courses required in the Cybersecurity track:**

- SE 330 – Introduction to Cybersecurity (Prerequisite(s): EE 305)
- SE 450 – Cryptography and Data Privacy (Prerequisite(s): STA 212, SE 330)
- SE 452 – Network Security (Prerequisite(s): EE 305, SE 330)
- SE 454 – Ethical Hacking and Systems Defense (Prerequisite(s): SE 330, SE 452)

**One additional course may be taken from the following list of track electives:**

- SE 440 - Special Topics in Software Engineering (Prerequisite(s): SE 324)
- SE 443 – Cloud Computing for Software Engineers (Prerequisite(s): SE 324, EE 305)
- SE 444 – Artificial Intelligence (Prerequisite(s): SE 214, SE 324)
- SE 446 – Introduction to Big Data (Prerequisite(s): SE 312, SE 314)
- SE 447 – Introduction to Machine Learning (Prerequisite(s): SE 312, SE 314)
- SE 448 – Blockchain Development (Prerequisite(s): SE 324)
- SE 451 – Secure Software Engineering (Prerequisite(s): SE 310, SE 330)
- SE 453 – Security Risk Management & Control (Prerequisite(s): SE 330)

## Course Descriptions

In this section, we give brief descriptions of courses in the Software Engineering program. Each course below follows the following format:

**Course code: Course Title Course credit hours (Lecture contact hours – Lab contact hours – Tutorial contact hours)**

Course Description

Prerequisite(s)

Co-requisites

### Core Courses

**SE 100: Programming for Engineers 3 (3-0-0)**

An introductory course designed to familiarize the student with modern software development techniques. Emphasis is on problem-solving and structured program design methodologies. Programming projects are implemented in Python. Course topics include an overview of the basic components of a computer system, introduction to programming languages, Python programs, numbers, variables, expressions, and standard input/output. Decision structures and nested decision structures. Repetition structures (while, for and nested for loops). User defined Functions including void functions, value returning functions as well as built in function libraries such as random and math. Concentration will also be on lists, tuples, and their associated methods. An overview of string functions as well as dictionaries and sets will be presented followed by handling files, text processing, and types of program exceptions. An introduction to Object Oriented concepts in Python will be visited towards the end.

Prerequisite(s): None

**SE 100 L: Programming for Engineers Lab 1 (0-2-0)**

Laboratory experiments focusing on programming fundamentals in Python.

Prerequisite(s): None

Co-requisites: SE 100

**SE 117: Software Practice and Society 3 (3-0-0)**

The significant role played by technology in our time and the resulting tensions between software technology and society are often viewed as defining aspects of modernity. This course will be to explore the extent to which interactions between software technology and society have always been central and to consider the extent to which many of today's debates concerning that relationship have been prefigured in earlier cultures.

Prerequisite(s): None

Co-requisites: None

**SE 120: Object-Oriented Programming I 3 (3-0-0)**

This course will build on the knowledge acquired in SE100. It will introduce students to a principal Object-Oriented language which is Java. The course will begin with an introduction to Java fundamentals such as the extended data types, exclusive string methods, repetition structures including for, while and do while loops, and writing methods. Aspects of arrays both single and multidimensional will be covered.



This course will then introduce current techniques in object-oriented design, analysis, and programming. Such topics as encapsulation, information hiding, inheritance and polymorphism will be tackled.

Prerequisite(s): SE 100

### **SE 120 L: Object-Oriented Programming I Lab** **1 (0-2-0)**

Laboratory experiments dealing with programming in Java (both procedural and object – oriented) will be covered.

Prerequisite(s): SE 100

Co-requisites: SE 120

### **SE 201: Introduction to Software Engineering** **3 (3-0-0)**

This course is designed to present students with a number of principles relevant to the field of Software Engineering. Models of software processes and development will be presented as well as the various stages of the software lifecycle. Important concepts such as agile development, requirements engineering, and project management will be presented to students. The course will focus at one stage on object – oriented methodology in performing analysis and design. Students are expected to develop a degree of practical experience in performing object – oriented analysis and design. Aspects such as Software testing and aspect-oriented software development will also be introduced. This course is characterized by being one that introduces concepts of several future courses that students will be covering in the program such as Requirements Analysis (SE225) and Software Design and Architecture (SE310).

Prerequisite(s): SE 120

### **SE 212: Discrete Structures for Software Engineers** **3 (3-0-0)**

This is an introductory course in discrete mathematics. The major objective of this course is to introduce students with techniques that are widely used in science and engineering. This course demonstrates how to think logically and mathematically and apply these techniques in problem solving. Topics to be covered include propositional logic and proofs, sets, functions, as well as induction, recursion, and mathematical reasoning. Other key topics involving relations, graphs, trees, and formal languages and computability will be covered in this course.

Prerequisite(s): SE 120

### **SE 214: Algorithms and Data Structures** **3 (3-0-0)**

In this very important course, students are exposed to a special category of data structures such as binary search trees, heaps, singly and doubly linked lists, generics, iterators, stacks, and queues. Students also work with a number of sorting algorithms such as linear sort, merge sort, heap sort, bubble sort and radix sort, carry out simple operations on graph data structures, learn about algorithm complexity including the big – O notation, and recognize which data structure is the most suited for the particular problem they are working on.

Prerequisite(s): SE 120

### **SE 214 L: Algorithms and Data Structures Lab** **1 (0-2-0)**

Laboratory experiments focusing on creation of the fundamental data structures and applying them to real life case studies.

Prerequisite(s): SE 120

Co-requisites: SE 214

### **SE 220: Object-Oriented Programming II** **3 (3-0-0)**





Extension of advanced and object-oriented programming techniques such as text I/O, binary I/O, graphical user interface (GUI), JavaFX, event-driven programming, animation, JavaFX controls and multimedia.

Prerequisite(s): SE 120

### **SE 220 L: Object-Oriented Programming II Lab** **1 (0-2-0)**

Laboratory experiments dealing with advanced Object-Oriented Programming.

Prerequisite(s): SE 120

Co-requisites: SE 220

### **SE 225: Software Requirements** **3 (3-0-0)**

Requirements engineering process. Methods, tools and techniques for eliciting, organizing and documenting software requirements. Analysis and validation techniques, including need, goal, and use case analysis. Requirements' documentation standards. Traceability. Requirements management. Handling requirements changes. Students participate in a group project on software requirements.

Prerequisite(s): SE 201

### **SE 225 L: Software Requirements Lab** **1 (0-2-0)**

Laboratory experiments dealing with software requirements.

Prerequisite(s): SE 201

Co-requisites: SE 225

### **SE 310: Software Design and Architecture** **3 (3-0-0)**

The course gives students an understanding of the concept of software architecture and how this phase in the development between requirement specification and detailed design plays a central role for the success of a software system. The students will get knowledge of some well-known architecture patterns, and be able to design, construct and evaluate architectures for software systems. In addition, the students should get some understanding of how the developers' experiences and the technical and organizational environment will influence on the choice of architecture.

Prerequisite(s): SE 225

### **SE 312: Database Management Systems** **3 (3-0-0)**

An overview of database management systems, entity-relationship model, relational model, relational algebra, relational database design improvement with normalization, and query optimization. Students will also be trained on implementing and complexly querying databases using Structured Query Language (SQL). The concept of the enhanced ER diagram will also be introduced in the database design component of the course; a first step in understanding Object – Oriented database design.

Prerequisite(s): SE 214

### **SE 312 L: Database Management Systems Lab** **1 (0-2-0)**

Laboratory experiments dealing with database management systems. Focus will be on using Oracle SQL as the main development tool.

Prerequisite(s): SE 214

Co-requisites: SE 312

### **SE 314: Operating Systems** **3 (3-0-0)**

Theory and construction of operating systems, including real-time and embedded systems aspect from an engineering point of view, stressing performance measurement and metrics. Quality of Service issues leading to certification that an operating system will satisfy hard real-time constraints.



Prerequisite(s): SE 214

**SE 314 L: Operating Systems Lab**

**1 (0-2-0)**

Laboratory experiments dealing with Operating Systems.

Prerequisite(s): SE 214

Co-requisites: SE 314

**SE 322: Internet of Things Application Development**

**3 (3-0-0)**

This course is designed to provide students with focused technical knowledge and skills to build Internet of Things (IoT) systems and applications. The course will cover the design of a microcontroller-based embedded system for Arduino Raspberry Pi platforms. Additionally, it will cover IoT paradigms, IoT design considerations, constraints and the development process for IoT applications in different sectors.

Prerequisite(s): SE 100, EE 305

**SE 324: Web Application Development**

**3 (3-0-0)**

This course focuses on the fundamentals of Web-based programming, Web application development and client-server database integration. It provides an in-depth coverage of introductory programming principles, various markup languages (e.g., XHTML, Dynamic HTML and XML), styling languages such as CSS, several scripting languages (e.g., JavaScript, PHP, Ruby/Ruby on Rails and Perl), Ajax, Web services, Web servers (e.g., IIS and Apache) and relational databases (e.g., MySQL/Apache Derby/Java DB)

Prerequisite(s): SE 312

**SE 324 L: Web Application Development Lab**

**1 (0-2-0)**

Laboratory experiments dealing with web application development.

Prerequisite(s): SE 312

Co-requisites: SE 324

**SE 328: Mobile Application Development**

**3 (3-0-0)**

This project-oriented course examines the principles of mobile application design and development. Students will learn application development on the Android platform. Topics will include memory management; user interface design; user interface building; input methods; data handling; network techniques and URL loading; and, finally, specifics such as GPS and motion sensing. Students are expected to work on a project that produces a professional-quality mobile application. Projects will be deployed in real-world applications.

Prerequisite(s): SE 225 and SE 312

**SE 328 L: Mobile Application Development Lab**

**1 (0-2-0)**

Laboratory experiments dealing with mobile application development.

Prerequisite(s): SE 225 and SE 312

Co-requisites: SE 328

**SE 330: Introduction to Cybersecurity**

**3 (3-0-0)**

This course provides students with a baseline understanding of common cyber security threats, vulnerabilities, and risks. The course also includes an introduction to basic cyber security risk analysis, with an overview of how threat-asset matrices can be used to prioritize risk decisions.

Prerequisite(s): EE 305

**SE 390: Software Engineering Summer Internship**

**(0 CRHs)**

An internship is an important aspect of Software Engineering curriculum that provides students with hands-on experience and a good sense of what an actual job in an organization will be like. Students are required to work for an IT department in a government or private entity during the summer semester for at least 8 weeks. Students usually complete their internships towards the end of their Junior (third) year. The main outcome is that they should be able to relate the internship experience to the knowledge that has been acquired throughout the Software Engineering program.

Prerequisite(s): SE 324

### **SE 412: Software Testing and Quality Assurance**

**3 (3-0-0)**

The course focuses on software verification and validation throughout the software life cycle, including reviews (inspections and walkthroughs), testing techniques (functional and structural – black box and white box), levels of testing (unit, integration, system, and acceptance), and testing tools (static and dynamic). Testing and quality assurance standards.

Prerequisite(s): SE 310

### **SE 414: Software Project Management**

**3 (3-0-0)**

The concepts and use of project management tools, techniques and methodologies are becoming very fundamental and commonplace. This course addresses project management in the context of software projects. Using the framework of the Project Management Body of Knowledge (PMBOK) initiated by the Project Management Institute (PMI), the course covers various aspects pertaining to project initiation, planning, scheduling, monitoring and control, and closure. For planning and scheduling of projects, the use of project network and estimation of time and cost will be elaborated on. Risk assessment methods will also be covered. This course is designed to form a stepping stone for those candidates wishing to pursue related certifications such as the Certified Associate in Project Management (CAPM), the newly introduced Project Management Ready credential, and later on the most demanded Project Management Professional (PMP) designation.

Prerequisite(s): SE 310

### **SE 423: Software Construction and Processes**

**3 (3-0-0)**

This course focuses on human-computer interaction as well as topics related to software maintenance, configuration management and evolution. Aspects such as User interface design and architectures will also be touched upon. Other HCI and usability related topics to be covered include: Assessment and evaluation of user interfaces, design of user interface components including windows, menus, and commands, Usability engineering, Task analysis, User-centered design, prototyping, conceptual models and metaphors, software design rationale, voice and natural language I/O. Response time and feedback. Color, icons, and sound. Software quality issues, defect detection and prevention, reliability engineering, examination of maintenance issues, configuration management. Software evolution issues, planning for evolution. The course will also introduce students to important business aspects related to Entrepreneurship and Innovation in the field of Software Engineering.

Prerequisite(s): SE 412

### **SE 440: Special Topics in Software Engineering**

**3 (3-0-0)**

This course provides instruction and experience in timely topics related to the design and development of quality-engineered software.

Pre-requisites: SE 324

### **SE 495: Software Engineering Capstone Project I**

**3 (0-6-0)**

This course is the first part of a two-semester long senior level capstone project. It is intended to complement the theory and to provide an in-depth, hands-on experience in all aspects of software

engineering. The students will work in teams on projects of interest to the IT sector and will be involved in analysis of requirements, architecture and design, implementation, testing and validation, project management, software process, software maintenance, and software re-engineering. In this part, students will work on the project plan, prepare and produce the software requirements specification document and develop the software high-level architecture and design.

Prerequisite(s): SE 310, SE 324

### **SE 496: Software Engineering Capstone Project II**

**3 (0-6-0)**

This is the second part of the capstone project started in SE 495 course. In this part, students provide an implementation of the design produced in SE 495, testing of the implementation both at the unit and system levels, and management and evaluation of their final product. Student teams must deliver the code, a final report document, as well as delivery of a presentation for and a demonstration of their final deliverable. .

Prerequisite(s): SE 495

### **Elective Courses**

#### **SE 435: Undergraduate Research in Software Engineering**

**3 (0-6-0)**

Students participate in supervised research with a faculty member. Supervised research can be: 1) independent research undertaken by the student (thesis, independent study), or 2) assistance on a faculty member's research project. Students must find a faculty member who is willing to supervise him/her as an assistant on an existing project or as the author of an individual project. The student and the faculty supervisor will complete and sign a research contract which will be turned in to the chair of the Electrical and Software Engineering Department. Drafting the contract will allow the student to develop ideas about what should be accomplished and what the faculty supervisor's expectations are. All academic requirements are at the discretion of the supervising faculty member. Students should agree on a plan for the semester with the faculty mentor before the research begins. The plan should include academic requirements, the basis for grading the experience, and a plan for student/professor meetings for the semester. It is the student's responsibility to report progress and seek guidance when needed. Students are expected to be active and reliable participants in the research experience.

Prerequisite(s): GPA of at least 3.7/4.0, signed research contract, and consent of the departmental chair.

#### **SE 440: Special Topics in Software Engineering**

**3 (3-0-0)**

This course provides instruction and experience in timely topics related to the design and development of quality-engineered software.

Prerequisite(s): SE 324

#### **SE 441: Telecommunications Software Design**

**3 (3-0-0)**

Formal models for telecommunications software design and analysis. Protocol specification, design and validation. Protocol verification and testing. Conformance testing. Protocol synthesis. Protocol conversion.

Prerequisite(s): EE 305

#### **SE 442: Social Networks for Software Engineers**

**3 (3-0-0)**

Students will learn the fundamental interface, systems, and algorithms concepts in designing social software. The case-based syllabus will cover insights from both research and industry. As a student, the student will contribute to this burgeoning field through a quarter-long, team-based project. Students are required to enter the class with an initial project idea.

Prerequisite(s): SE 324

### **SE 443: Cloud Computing for Software Engineers**

**3 (3-0-0)**

This course will leverage the World Wide Web to fulfill computing needs. It packages applications, computing power, and storage as a metered service similar to a utility. This model is designed to supplant the traditional mechanism of desktop computing in many cases. This course will cover the origin, theory, enabling technology, and hands-on labs for key concepts in cloud computing.

Prerequisite(s): SE 324, EE 305

### **SE 444: Artificial Intelligence**

**3 (3-0-0)**

This course aims in developing computer applications, which encompasses perception, reasoning and learning and to provide an in-depth understanding of major techniques used to simulate intelligence.

Prerequisite(s): SE 214, SE 324

### **SE 445: Information and Software Security**

**3 (3-0-0)**

This course provides an introduction to the topic of security in the context of computer networks. The goals are to provide students with a foundation allowing them to identify, analyze, and solve network-related security problems in information systems with the emphasis on the engineering aspects of information security and software security issues.

Prerequisite(s): STA 212, SE 324

### **SE 446: Introduction to Big Data**

**3 (3-0-0)**

In this course the students will learn the Big Data platform and data governance in order to efficiently store and manage massive amounts of data. In addition, they will learn Big Data architecture, such as Hadoop, Map Reduce, Hbase, Big SQL and BigSheets. Students will use tools to capture, store and analyze structured and unstructured data.

Prerequisite(s): SE 312, SE 314

### **SE 447: Introduction to Machine Learning**

**3 (3-0-0)**

This course introduces machine learning with a practical approach covering some of the most common learning models, algorithms, tools, and techniques. From supervised learning, it covers linear regression, logistic regression, and neural networks. From unsupervised learning, it covers K-means clustering, dimensionality reduction (principal component analysis), and anomaly detection. The course also discusses practical aspects considered when applying machine learning: data visualization, model selection, flow, model evaluation (testing, validation, overfitting, underfitting, bias, variance), regularization, and large scale machine learning.

Prerequisite(s): SE 312, SE 314

### **SE 448: Blockchain Development**

**3 (3-0-0)**

In this course the students will learn concepts of the Blockchain technology such as business networks, participants, assets, and trusted transactions. They will also learn how to develop a complete Blockchain network solution using up-to-date tools and platforms.

Prerequisite(s): SE 324