جامعة حائل
University of Ha'il

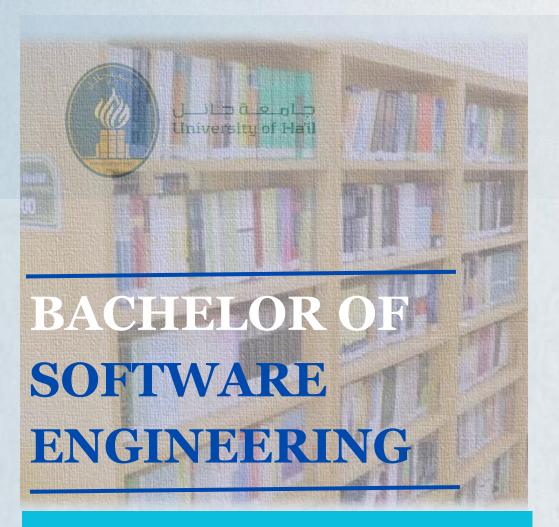# SOFTWARE ENGINEERING

Academic Program Guide

2023

CONTENTS

BACHELOR OF
SOFTWARE
ENGINEERING

Admission requirements:

The number of accepted is determined the college councils and the deanship of
Admission and registration. The conditions for accepting students are as follows:

1. An official high school certificate is required From inside or outside the kingdom of Saudi Arabia.

2. The high school certificate is valid for 5 years for acceptance, exceptions in this regard is Referred to the university council.

3. Applicants must have a character certificate of good conduct.

4. Applicants must pass all examinations and Interviews conducted by the university council.

5. applicants must be medically fit.

6. If the applicant is working, no objection letter from the employer is required.

7. Applicant must fulfill any other conditions or requirements required by the university council during the admission process.

8. The competition between applicants depends on high school percentage, interviews and Acceptance exam such as (qudurat and tahsili).

9. The minimum passing percentage of high school certificate and examinations may vary every year depending on the number of students and the number of available seats in the course.

Admission in the college majors depends on Preparatory year GPA, applicants' choices, and seats available

BACHELOR OF SOFTWARE ENGINEERING

GRADUATION REQUIREMENTS:

Students in the Software Engineering (SWE) program are required to complete 155 semester-credit-hours covering general educational requirements, core requirements and some elective courses.

ARTICLE (19):

A student graduates after successfully completing the graduation requirements according to the degree plan, provided his cumulative GPA not less than "PASS". Following the recommendation of the department council, the college council may determine certain additional courses the student should take to improve his cumulative GPA if he has passed the required courses, but with a low GPA.

Kingdom of Saudi Arabia
Ministry of Education
University of Hail
College of Computer Science and Engineering

المملكة العربية السعودية
وزارة التعليم
جامعة حائل
كلية علوم وهندسة الحاسب الآلي

CCSE
University of Hail
2005
كلية علوم و هندسة الحاسب الآلي
College of Computer Science and Engineering

Bachelor's degree Plan of Software Engineering (SENG)

First Year

Level 1 (18 Credits)					Level 2 (16 Credits)				
Code	Title	Crd	Lec	Lab	Prerequisite	Code	Title	Crd	Lec	Lab	Prerequisite
ENGL 100	English Language	2	2	0		MATH 102	Calculus II	4	4	0	MATH 101
ETEC 115	Computer and Information	2	2	0		ENGL 1005	Intermediate English	4	4	0	ENGL 1004
MATH 101	Calculus I	4	4	0		ENG 0023	Engineering Drawings and Modelling	2	1	3	ENG 0013
PHYS 101	General Physics	4	3	3	MATH 101	CSCE 0213	Critical Thinking and Study Skills	2	2	0	
ENGL 1004	Pre-intermediate English	4	4	0		CSCE 0313	Creativity and Innovation	2	2	0	
ENG 0013	Engineering Principle	2	2	0		CSCE 0323	Interactive and Communication Skills	2	2	0	
Total =		18	17	3		Total =		16	15	3	

Second Year

Level 3 (15 Credits)					Level 4 (15 Credits)				
Code	Title	Crd	Lec	Lab	Prerequisite	Code	Title	Crd	Lec	Lab	Prerequisite
CSCE 101	Computer Programming I	4	2	4		CSCE 102	Computer Programming II	4	2	4	CSCE 101
ENGL 109	English for Computer	2	2	0		SENG 231	Intro. to Software Engineering	3	2	2	CSCE 101
CENG 121	Digital Logic	4	3	2	PHYS 101	MATH 201	Calculus III	3	3	0	MATH 102
CSCE 121	Discrete Structures	3	3	0	MATH 101	CRCL 115	University Life Skills	3	3	0	
ARB 100	Arabic Language Skill	2	2	0		IC 111	Islamic Culture	2	2	0	
Total =		15	12	6		Total =		15	12	6	

Third Year

Level 5 (14 Credits)					Level 6 (15 Credits)				
Code	Title	Crd	Lec	Lab	Prerequisite	Code	Title	Crd	Lec	Lab	Prerequisite
SENG 232	Data Structures & Algorithms	4	3	2	CSCE 102	SENG 241	Software Requirements Engineering	3	3	0	SENG 231
SENG 233	Ethics in Software Engineers	2	2	0		SENG 242	User Experience Design	3	3	0	SENG 231
CSCE 233	Probability & Statistics	3	2	2	CSCE 121	SENG 243	Programming Languages & Paradigms	3	3	0	SENG 232
MATH 260	Intro. to Diff. Eq & Lin. Algebra	3	3	0	MATH 102	CENG 241	Computer Organisation	4	3	2	CENG 121
EDUC 115	Work Values and Ethics	2	2	0		EDUC 125	Entrepreneurship	2	2	0	
Total =		14	12	4		Total =		15	14	2	

Fourth Year

Level 7 (18 Credits)					Level 8 (16 Credits)				
Code	Title	Crd	Lec	Lab	Prerequisite	Code	Title	Crd	Lec	Lab	Prerequisite
SENG 351	Database Management Systems	4	3	2	SENG 232	SENG 361	Engineering Software as a Service	3	3	0	SENG 232
SENG 352	Software Design & Architecture	3	3	0	SENG 241 & SENG 242	SENG 362	Web Engineering	4	2	4	SENG 351
SENG 353	Software Project Management	2	2	0	SENG 231	SENG 363	Software Modelling & Simulation	3	2	2	SENG 352
SENG 354	Software Engineering Seminar	1	1	0		SENG 364	Software Testing & Quality Assurance	3	2	2	SENG 352
CSCE 352	Operating Systems	4	3	2	CENG 241	SENG 365	Security Fundamentals	3	2	2	SENG 243
CSCE 353	Computer Networks	4	3	2	CENG 241						
Total =		18	15	6		Total =		16	11	10	

Summer Session

Code	Title	Crd	Lec	Lab	Prerequisite
SENG 400	Summer Training (0 Credit) - 85 Hours	0	0	0	SENG 362 & SENG 364

Fifth Year

Level 9 (12 Credits)					Level 10 (16 Credits)				
Code	Title	Crd	Lec	Lab	Prerequisite	Code	Title	Crd	Lec	Lab	Prerequisite
SENG 401	COOP Training	10	6	0	SENG 362 & SENG 364	SENG 480	Graduation Project II	4	1	6	SENG 470
SENG 470	Graduation Project I (online)	2	2	0	SENG 362 & SENG 363	Elective	SENG Elective I	3	3	0	
						Elective	SENG Elective II	3	3	0	
						Elective	SENG Elective II	3	3	0	
						Elective	Free Course	3	3	0	
Total =		12	8	0		Total =		16	13	6	

Total Requirements (155 credit hours)

Kingdom of Saudi Arabia
Ministry of Education
University of Hail
College of Computer Science and Engineering

المملكة العربية السعودية
وزارة التعليم
جامعة حائل
كلية علوم وهندسة الحاسب الآلي

Bachelor's degree Plan of Software Engineering (SENG)

List of SENG Electives

Code	Title	Crd	Lec.	Lab	Prerequisite
SENG 490	Selected Topics I	3	3	0	
SENG 491	Selected Topics II	3	3	0	
SENG 492	Mobile Application Development	3	3	0	
SENG 493	Game Design & Development	3	3	0	
SENG 494	Advanced Computer Programming	3	3	0	
SENG 495	Research Methodology	3	3	0	
SENG 496	Information Visualization	3	3	0	
SENG 497	Secure Software Engineering	3	3	0	
SENG 498	Fund. of Artificial Intelligence	3	3	0	
SENG 499	Fund. of Data Sciences	3	3	0	

List of Free Electives

Code	Title	Crd	Lec.	Lab	Prerequisite
ECN 101	Principles of Microeconomics	3	3	0	
ECON 403	Engineering Economics	3	3	0	
MGT 101	Principles of Management	3	3	0	
MGT 212	Legal Environment	3	3	0	
MKT 101	Principles of Marketing	3	3	0	
SCOL 101	Principles of Sociology	3	3	0	

Courses description

Course Code:	CSCE101
Course Name:	Computer Programming- I
Credit:	4 Credit (2 Hrs. Lectures and 4 Hrs. Lab)
Prerequisite:	None

Overview on programming languages. An Introduction to an object-oriented programming language. Basic data types and operators, console input/output, logical expressions, control structures, arrays, strings, classes, objects, methods.

Course Code:	CENG121
Course Name:	Digital Logic
Credit:	4 Credit (3 Hrs. Lectures and 2 Hrs. Lab)
Prerequisite:	PHYS101

Introduction to information representation and number systems. Boolean algebra and switching theory. Manipulation and minimization of completely and incompletely specified Boolean functions. Physical properties of gates: fan-in, fan-out, propagation delay, timing diagrams and tri-state drivers. Combinational circuits are designed using multiplexers, decoders, comparators and adders. Sequential circuit analysis and design, basic flip-flops, clocking and timing diagrams. Registers, counters, RAMs, ROMs, PLAs, PLDs, and FPGAs. Use of CAD tools to design, simulate and implement digital logic circuits on FPGA prototyping boards.

Course Code:	CSCE121
Course Name:	Discrete Structures
Credit:	3 Credit (3 Hrs. Lectures and 0 Hrs. Lab)
Prerequisite:	MATH101

Logic (Propositional Logic - Propositional Equivalences - Predicates and Quantifiers - Nested Quantifiers); Proof Methods and Strategy - Mathematical and Strong Induction; Sequences and Summations; Number theory (Divisibility and Modular Arithmetic - Primes and Greatest Common Divisors); Graphs (Graph Terminology and Special Types of Graphs & tree - Representing Graphs and Graph Isomorphism - Connectivity - Euler and Hamilton Paths); Automata Theory (Finite State Machines; Regular Expressions, DFA, NDFA).

Course Code:	CSCE102
Course Name:	Computer Programming- II
Credit:	4 Credit (2 Hrs. Lectures and 4 Hrs. Lab)
Prerequisite:	CSCE101

Advanced object-oriented programming; inheritance, polymorphism, abstract classes and interfaces; container and collection classes; packages; exception handling; event handling, swing threads; recursion, GUI interface.

Course Code:	SENG231
Course Name:	Introduction to Software Engineering
Credit:	3 Credit (2 Hrs. Lectures and 2 Hrs. Lab)
Prerequisite:	CSCE101

This course introduces Software Engineering as a systematic, disciplined, and quantifiable approach to support the analysis, design, development, operations, and maintenance of software-intensive systems. The course primarily aims for a systematic application of engineering to the software. It cover topics that include but not limited to software engineering process models, requirements engineering processes, and system models with emphasis on methods, tools, notations, and validation techniques for the analysis and specification of software requirements. Based on a practical approach, students will be exposed to scenario-driven approaches for designing software, practice requirements engineering, systems modeling, object orientation and exploit UML notations and tools within a team-drive environment to engineer software-intensive systems.

Course Code:	CSCE233
Course Name:	Probability & Statistics
Credit:	3 Credit (2 Hrs. Lectures and 2 Hrs. Lab)
Prerequisite:	CSCE121

This course provides students with an understanding of statistical analysis and applications. Also, fundamental concepts of the probability theory are taught. The course includes describing, displaying and exploring statistical data, measurers of location, variability, regression analysis, statistical analysis in model building, probability, random variables & its probability distribution, counting technique, statistical testing.

Course Code:	SENG232
Course Name:	Data Structures and Algorithms
Credit:	4 Credit (2 Hrs. Lectures and 4 Hrs. Lab)
Prerequisite:	CSCE102

This course teaches techniques for the design and analysis of efficient algorithms, emphasizing methods useful in practice. Topics include: Arrays, Lists, Recursion, Stacks, Queues Searching (Linear and binary searching). Efficiency and Complexity (Time versus space complexity, Concrete measures for performance and Big-O notation). Trees (General specification of trees, Binary trees, Implementation of trees and Recursive algorithms, Time complexity of insertion and search and Self-balancing AVL trees). Priority Queues and Heap Trees (Building a new heap tree from scratch, Binomial heaps and Comparison of heap time complexities). Sorting (Bubble, Insertion and Selection Sort, Comparison of $O(n2)$ sorting algorithms and Divide and conquer algorithms) Hash Tables(Implementations of the table data structure, Collision likelihoods and load factors for hash tables, Linear Probing, Double Hashing and Complexity of hash tables). Graphs (Implementing graphs, Traversals, Shortest paths – Dijkstra's and Floyd's algorithm, Minimal spanning trees and Travelling Salesmen and Vehicle Routing... In homework, labs, and programming projects, students will implement their own data structures and make use of existing libraries to solve a variety of computational problems.

Course Code:	SENG233
Course Name:	Ethics in Software Engineering
Credit:	2 Credit (2 Hrs. Lectures and 0 Hrs. Lab)
Prerequisite:	None

This course is an introduction information ethics in general and to the professional and ethical aspects of the profession of software engineers in order to be able to fulfill their duties and succeed in their mission. Ethics of Software Engineers and ethical behavior is covered in depth through the IEEE-CS/ACM software engineering code of ethics (with the respect to PUBLIC INTEREST, CLIENT and EMPLOYER, PRODUCT, JUDGMENT, MANAGEMENT, PROFESSION, COLLEAGUES, and SELF). The course covers also other important topics: Software Engineering as an engineering and computing discipline; Professional aspects of the Software Engineer profession: certification, licensing, professional engineering societies, employment contracts, etc.; Group Dynamics, interaction with peers, stakeholders, and managers; Communication and presentation skills; Economic impact of Software systems; legal, social, etc.

Course Code:	SENG242
Course Name:	User Experience Design
Credit:	3 Credit (3 Hrs. Lectures and 0 Hrs. Lab)
Prerequisite:	SENG231

The course of user experience introduces the fields of user experience design and research. Students will understand about what is involved in user experience research, including conducting interviews, evaluating systems and analyzing systems using principles of good design and practices. Students will also learn about the tasks involved in a user experience design including developing auspicious design solutions, creation of prototypes at multiple levels of perspectives. By incorporating successive phases of steps for user interface design cycle the students will get exposure to a set of techniques to gather information about what the user needs, how to design and model interfaces based on these and how to evaluate the design to ensure that the user's requirements are met.

Course Code:	SENG241
Course Name:	Software Requirement Engineering
Credit:	3 Credit (3 Hrs. Lectures and 0 Hrs. Lab)
Prerequisite:	SENG231

This course teaches the fundamental theory, techniques, processes and practices to capture software requirements as the building blocks to engineer and develop software-intensive systems. The course introduces both the functional and non-functional (also referred to as quality requirements) in the context of software engineering process. The course introduces the requirement engineering process to extract, analyze, priorities, document, implement and validate the requirements. Special focus is maintained on methods and techniques to interact with the clients to extract information and document them in prescribed documents and templates. Students are encouraged and facilitated to work on identification or requirements and their representation as use cases.

Course Code:	SENG243
Course Name:	Programming Languages & Paradigms
Credit:	3 Credit (3 Hrs. Lectures and 0 Hrs. Lab)
Prerequisite:	SENG232

There are a variety of programming languages designed with different features aiming to address different types of problems. The unit is an advanced course for students who have already mastered one programming language. It is trying to consider the broad spectrum of different programming paradigms and how these can be used and translated.

Course Code:	SENG352
Course Name:	Software Design & Architecture
Credit:	3 Credit (3 Hrs. Lectures and 0 Hrs. Lab)
Prerequisite:	SENG241 & SENG242

Object orientation. Development on reusable technology, Developing requirements. Modeling with classes, UML, Various Design Patterns. Interaction, state, activity, sequence diagrams and implementations. Process of design, Various design principles. Design decisions. Model Driven Development. Software architecture, Various architectural patterns. Design document. Risks in design. Students participate in a group project on software design.

Course Code:	SENG351
Course Name:	Database Management Systems
Credit:	4 Credit (3 Hrs. Lectures and 2 Hrs. Lab)
Prerequisite:	SENG232

This course introduces theoretical, practical and commercial aspects of database design, development, management and implementation. Database are considered as prime requirement for modern commercial, systems and generic software' development. Frontend applications needs supports of backend database systems. The course focuses on database software development covering various perspectives for application, web and systems. The course describes various aspect of database system environment, design, modeling, implementation, storage, processing, retrieval, recovery and concurrency management. The topics of study include data models, storage models, transaction processing techniques, concurrency control mechanism, SQL query processing, database-oriented CASE tools, reports and other interfaces to database data.

Course Code:	CSCE352
Course Name:	Operating Systems
Credit:	4 Credit (3 Hrs. Lectures and 2 Hrs. Lab)
Prerequisite:	CENG241

This course introduces the fundamentals of operating systems design and implementation. Topics include history and evolution of operating systems; Types of operating systems; Operating system structures; Process management: processes, threads, CPU scheduling, process synchronization and deadlocks; Memory management and virtual memory; File systems; I/O systems; Security and protection; Distributed systems. The class will be presented using a both theory and case studies.

Course Code:	CSCE353
Course Name:	Computer Networks
Credit:	4 Credit (3 Hrs. Lectures and 2Hrs. Lab)
Prerequisite:	CENG241

Introduction to computer networks and layered architectures: connectivity, topology, circuit and packet switching, TCP/IP and ISO models; Application layer: C/S model, DNS, SMTP, FTP, WWW, socket programming and network security; Transport layer: TCP and UDP, congestion control; Network layer: internetworking, addressing and routing algorithms and protocols; Data link layer: framing, flow and error control protocols, PPP, MAC and LANs; Physical layer: principles of data communications, circuit switching, coding, multiplexing and transmission media.

Course Code:	SENG354
Course Name:	Software Engineering Seminar
Credit:	1 Credit (1 Hrs. Lectures and 0 Hrs. Lab)
Prerequisite:	None

The oral propagation, presentation and defence of technical, scientific and engineering thoughts and concepts are fundamental communication tools that students need to apply throughout their professional career. In this course, students will participate in five activities as observation, question, critique, research and presentation which will enhance their oral presentation skills.

Course Code:	SENG361
Course Name:	Engineering Software as a Service
Credit:	3 Credit (3 Hrs. Lectures and 0 Hrs. Lab)
Prerequisite:	SENG232

This module provides students with the knowledge and skills required for engineering Software as a Service (SaaS). Students will learn and use state of the art industry practices from the Agile software development paradigm such as Scrum, Behavior Driven Development, Test Driven Development and Continuous Deployment, to build SaaS applications. The course will use technologies such as Ruby on Rails, GitHub, Cucumber and RSpec to aid development. This course will cover both the theoretical concepts required to engineer SaaS in Cloud based web applications.

Course Code:	SENG353
Course Name:	Software Project Management
Credit:	2 Credit (2 Hrs. Lectures and 0 Hrs. Lab)
Prerequisite:	SENG231

This course introduces why all software development organizations are highly concerned for efficient management of their software development procedures. The software is intangible product so how it's development should be managed so that the target product is able to fulfil the client requirements efficiently without a great toll on development organization. Software project management focuses on the management of complete bunch of procedures of software development from client requirement gathering to testing and maintenance in a specified period to achieve intended software product. This course covers the topics of study as software development organization and structure, project planning & management, project budgeting and scheduling, project monitoring and controlling, risk management, configuration management, team organization and management, quality assurance and testing management, project closure, agile management, application of emerging management practices.

Course Code:	SENG362
Course Name:	Web Engineering
Credit:	4 Credit (2 Hrs. Lectures and 4 Hrs. Lab)
Prerequisite:	SENG351

This course aims at teaching the methods and techniques for testing and validating software systems to ensure their quality. The course helps student to learn the well-known and emerging patterns and styles such as Client-Server, Publish-Subscribe, 3Layerd, Model View Controller to engineer web applications effectively and efficiently. Previously taught topics on Database Systems, Software Engineering, Software Design and Architecture, Computer Programming are extended in the context of web engineering and development. Main topics that are covered include but not limited to requirements engineering for Web, layered application development, interface and usability design, operation and maintenance of Web applications. Specific focus is maintained on hand-on experience with tools and technologies relevant to Client side scripting (HTML, JavaScript, and CSS) and Server side programming (PHP, ASP.NET or other relevant technologies) with backend Databases (Web and/or NoSQL Databases).

Course Code:	SENG365
Course Name:	Security Fundamentals
Credit:	3 Credit (2 Hrs. Lectures and 2 Hrs. Lab)
Prerequisite:	SENG243

This course will provide a basic introduction to of all aspects of security including:
Security fundamentals, Information assurance concepts (confidentiality, integrity, and availability), Nature of threats (e.g., natural, intentional, and accidental), Encryption, digital signatures, message authentication, and hash functions, Common cryptographic protocols (applications, strengths and weaknesses), on technical security issues like social engineering, Computer and network security, Network security threats and attacks, Cloud Security, IoT Security, Malware and vulnerability analysis, Role of Forensics in Security, Protection and defense mechanisms and tools, developing and implementing secure software embedding security into the software development life cycle, Security requirements analysis and specification, Secure design principles and patterns. Secure software construction techniques, Security-related verification and validation, design and implementation of security policy and procedures, security management, private issues, legal issues, political issues, and technical issues.

Course Code:	SENG364
Course Name:	Software Testing & Quality Assurance
Credit:	3 Credit (2 Hrs. Lectures and 2 Hrs. Lab)
Prerequisite:	SENG352

This course aims at teaching the methods and techniques for testing and validating software systems to ensure their quality, where testing is considered as means to achieve the desired quality. The course introduces the types (functional and non-functional) and levels of testing including: Black Box and White Box testing, test plan and Decision-Table based Testing Technique, Test Metrics and Test Tracking, Dataflow, Unit, Integration, and Configuration Management for Integration and System Testing with Different models for Interaction Testing. The course covers Systems and Regression Testing Techniques using Threads and Operational Profile; Relationship to Customer "Acceptance" Test, Interaction Testing and Modeling Techniques using Petri-Net, State Machine, Object Oriented Classes, etc.) of testing, and then applies them to ensure the quality aspects (efficiency, usability, availability etc.) of Software-Intensive Systems. The course emphasizes to the process, methods and documents such as test-case templates to document the software testing process. ISO/IEC-9126 model is introduced that provides objective criteria to validate the software systems. Both manual and automated testing techniques are explored in detail. Tools for automated testing such as JUnit and LoadRunner are introduced to support practice-driven approach and hands-on session to teaching the fundamental theory and practical knowledge of software testing and quality assurance.

Course Code:	SENG470
Course Name:	Graduation Project-I (online)
Credit:	2 Credit (2 Hrs. Lectures and 0 Hrs. Lab)
Prerequisite:	SENG362 & SENG363

Graduation project-1 will guide students to conduct a critical background study on their chosen topic. It will assist them on requirements gathering including analysis and synthesizes of gathered data and will aid students to perform feasibility study and functional and non- functional requirements to accumulate problems respective to their topic/environment
Graduation project I integrates software engineering knowledge and skills acquired in previous courses. Students can use team-based approach to problem formulation, requirements engineering, architecture, and design of software system that solves a real-world problem. In particular, Graduation project I helps students to:
- Select an appropriate project in the domain of software engineering.
- Research the project for existing references, solution strategies and techniques.
- Choose a software development process (Unified Software Development Process, or an agile process) to follow through the development of the solution.
- Gather the requirements.
Produce the design document.

Course Code:	ECON403
Course Name:	Engineering Economics
Credit:	3 Credit (3 Hrs. Lectures and 0 Hrs. Lab)
Prerequisite:	None

Introduction to concepts of economic decision-making from a cash flow viewpoint. It includes present worth analysis, cash flow equivalence, rates of return, replacement analysis, cost benefit analysis, project cash flow analysis, and sensitivity analysis.

Course Code:	SENG480
Course Name:	Graduation Project-II
Credit:	4 Credit (1 Hrs. Lectures and 6 Hrs. Lab)
Prerequisite:	SENG470

Graduation project-2 will allow the students to use their acquired knowledge throughout the program to implement the design that proposed in graduation project-1 Graduation project II helps students to:

- Construct or continue evolve the software project he or she has started in Graduation Project II (SENG 470).
- Perform continued execution of the Unified Process or another process
- Perform more iteration on the documents produced in SENG 470, as well as re-factoring the existing design and/or code.
- Students will be able to work individually as well as in a team
- Students will be guided to maintain ethical issues, documentation formats, develop presentation and communication skills, use of references and checking plagiarism.

Finally, students will produce a runnable software/developed system in real time along with the final version of project report.

SWE Electives

Course Code:	SENG490
Course Name:	Selected Topics I
Credit:	3 Credit (3 Hrs. Lectures and 0 Hrs. Lab)
Prerequisite:	None

This emerging paradigm, namely the Internet of Things (IoT), has great impact on how individuals live and work by providing a source of innovative decision making.

To prepare our students as forerunners of this future, this course will introduce a wide range of topics in the broad areas of IoT, and provide hands-on experiences via a series of exciting projects.

Free Elective

Course Code:	COE446
Course Name:	Mobile Computing
Credit:	3 Credit (3 Hrs. Lectures and 0 Hrs. Lab)
Prerequisite:	Senior standing

Introduction to different types of mobile computing; cellular networks, wireless mobile ad hoc and sensor networks, wireless LAN and so on. Discussion of different IEEE standardized protocols and their implementation and performances. New wireless technologies such as LTE and LTE advance. Quality of Service (QoS) issues.
Modeling and optimization methods of wireless protocols.

Course Code:	COE 421
Course Name:	Fault Tolerant Computing
Credit:	3 Credit (3 Hrs. Lectures and 0 Hrs. Lab)
Prerequisite:	Senior standing

Introduction to fault-tolerant computing (FTC). Goals of fault tolerance (FT). Design techniques to achieve FT. Evaluation of FT systems. Reliability modeling and analysis of FT systems. Availability modeling. Logic-level fault testing and tolerance. Error detection and correction. Diagnosis and reconfiguration for system-level malfunctions.
Case studies of practical fault tolerant systems.

Course Code:	COE 486
Course Name:	Introduction to Robotics
Credit:	3 Credit (3 Hrs. Lectures and 0 Hrs. Lab)
Prerequisite:	Senior standing

Taxonomy of robots, Internet robotics, autonomous robots, robotic sensor networks, and applications. Motion, linear algebra, motion coordination, singularities, and multiple solutions. Vision, sensing and perception, robot vision and programming, self-localization, Kalman and Monte-Carlo approaches. Intelligence, Autonomous robotics, robot mechanisms and control, control and planning architectures, reactive, deliberative control behaviors, behavior-based control programming. Humanoid robots. Introduction to multi-robot systems.

Course Code:	ICS 435
Course Name:	Computer Graphics
Credit:	3 Credit (3 Hrs. Lectures and 0 Hrs. Lab)
Prerequisite:	ICS 202

Applications of Computer Graphics; Graphics systems and devices; Output Primitives and their Attributes; Geometric Transformations; Window to Viewport Mapping and Clipping; Curves and Surfaces; Three-Dimensional viewing; Hidden surface removal; illumination and color models, Animation.

Course Code:	ICS 424
Course Name:	Advanced Database Systems
Credit:	3 Credit (3 Hrs. Lectures and 0 Hrs. Lab)
Prerequisite:	ICS 334

Advanced data models: object-oriented model, object-relational model, conceptual database design. Transaction processing: transactions, failure and recovery, and concurrency control techniques. Database backup and recovery. Query processing and optimization. Database security. Distributed databases: distributed data storage, distributed query processing, distributed transaction processing, and concurrency control. Homogeneous and heterogeneous solutions, client-server architecture. XML and relational databases. Introduction to data warehousing, introduction to other current trends in database systems.

Course Code:	ICS 481
Course Name:	Artificial Neural Networks
Credit:	3 Credit (3 Hrs. Lectures and 0 Hrs. Lab)
Prerequisite:	Senior Standing

Introduction to neural computing: Real vs. artificial neurons; Threshold logic; Training a linear threshold unit, the perceptron rule; Multilayer feed-forward networks and the backpropagation algorithm; The Hopfield net; Self-organizing maps; Radial basis functions; Adaptive resonance theory; Applications of Neural Networks (ANN).

Course Code:	STAT320
Course Name:	Statistical Quality Control
Credit:	3 Credit (3 Hrs. Lectures and 0 Hrs. Lab)
Prerequisite:	STAT319

How control charts work. Control chart methods for attributes and variables. Process- control chart techniques. Process-capability analysis. Acceptance sampling by attributes and variables.

Course Code:	SENG495
Course Name:	Research Methodology
Credit:	3 Credit (3 Hrs. Lectures and 0 Hrs. Lab)
Prerequisite:	None

This course focuses on analytical, argumentative, and research writing, with an emphasis on research strategies and the finer points of advanced academic writing. Students will study and learn to utilize various analytical heuristics to improve their reading, critical thinking, and writing skills. Emphasis will be on the methods of process-based research writing, including library and note-taking strategies, using inquiry to guide research, peer-review workshops, and utilizing citation styles. Students should learn number of academic research methods. Students will be required to conduct a research project.

Course Code:	SENG469
Course Name:	Information Visualization
Credit:	3 Credit (3 Hrs. Lectures and 0 Hrs. Lab)
Prerequisite:	None

This course focuses on designing and creating visual representations of the available data and tasks to be achieved. Students will learn the processes of data modeling, data processing, mapping data attributes to graphical attributes, and strategic visual encoding based on known properties of visual perception as well as the task(s) at hand. In addition, students will also learn to evaluate the effectiveness of visualization designs and think critically about each design decision, such as choice of color and choice of visual encoding.

Course Code:	ICS 426
Course Name:	Data Warehousing and Data Mining
Credit:	3 Credit (3 Hrs. Lectures and 0 Hrs. Lab)
Prerequisite:	ICS 334

Review of relational databases and Conjunctive queries, Data Warehousing Concepts and OLAP, Data Warehouse Design and Development, Information and data Integration, and OLAP Technology for Data Mining. Data Mining: Primitive, Languages and Application Developments.

Course Code:	SENG493
Course Name:	Game Design and Development
Credit:	3 Credit (3 Hrs. Lectures and 0 Hrs. Lab)
Prerequisite:	None

This is an introductory course in game design and development. This course covers many of the concepts involved in game design, beginning with the history of gaming and an examination of the software engineering aspects of game design. Other topics include the programming environment, game hardware, mathematical concepts, physical concepts, and graphics. This course will prepare students for advanced courses in game design.

Course Code:	SENG499
Course Name:	Fund. of Data Science
Credit:	3 Credit (3 Hrs. Lectures and 0 Hrs. Lab)
Prerequisite:	None

Students will be able to learn concepts, techniques, and tools they need to deal with various facets of data science practice, including data collection and integration, exploratory data analysis, predictive modeling, descriptive modeling, data product creation, evaluation, and effective communication. The emphasis will be placed on the integration and synthesis of concepts and their application to solving problems. To make the learning contextual, real datasets from a variety of disciplines will be used.

Course Code:	STAT375
Course Name:	Categorical Data Analysis
Credit:	3 Credit (3 Hrs. Lectures and 0 Hrs. Lab)
Prerequisite:	STAT319

2x2 contingency tables, two-way contingency tables, three-way and higher dimensional contingency tables. Log linear models for contingency tables. Logistic regression. Building and applying log-linear models.

Course Code:	SENG494
Course Name:	Advanced Computer Programming
Credit:	3 Credit (3 Hrs. Lectures and 0 Hrs. Lab)
Prerequisite:	None

This module exposes students to the depth and breadth of modern programming practice, with the goal of making students better programmers. It is, however, an advanced-level module in which some advanced programming concepts are taught.

Course Code:	SENG 490
Course Name:	Special Topic-I
Credit:	3 Credit (3 Hrs. Lectures and 0 Hrs. Lab)
Prerequisite:	Senior standing

This emerging paradigm, namely the Internet of Things (IoT), has a great impact on how individuals live and work by providing a source of innovative decision-making.
To prepare our students as forerunners of this future, this course will introduce a wide range of topics in the broad areas of IoT, and provide hands-on experiences via a series of exciting projects.

Course Code:	SENG 498
Course Name:	Fund. of Artificial Intelligence
Credit:	3 Credit (3 Hrs. Lectures and 0 Hrs. Lab)
Prerequisite:	None

Upon completion of this course, students will be able to:
1. Understand the meaning of AI, its alternative approaches and the implications of AI for cognitive science more broadly.
2. Expand their knowledge about mechanisms, semantic networks, frame systems, heuristic search, genetic algorithms, planning, and symbolic learning algorithms.
3. Understand the basic methods in planning and reasoning using both logic and uncertain inference.
4. Know a variety of ways to represent and retrieve knowledge and information [Expert systems, Agents].

Know the fundamentals of AI programming techniques and advanced machine learning in a modern programming language.

Course Code:	MGT101
Course Name:	Principles of Management
Credit:	3 Credit (3 Hrs. Lectures and 0 Hrs. Lab)
Prerequisite:	None

Overview of the evolution of management thought; the business environment and context; the basic functions of planning, organizing, staffing, leading and controlling; the basic processes of leadership, decision making, communication, and motivation; groups, teams, conflict, power, and politics; and overview of the fields of human resources management, operations management, management information systems, international management, and organizational change and development.

Course Code:	COE487
Course Name:	Computer Vision Processing
Credit:	3 Credit (3 Hrs. Lectures and 0 Hrs. Lab)
Prerequisite:	Senior Standing

Introduction to the concepts and applications in computer vision. Cameras and projection models, low-level image processing methods such as filtering and edge detection; mid-level vision topics such as segmentation and clustering; shape reconstruction from stereo, as well as high-level vision tasks such as object recognition, scene recognition, face detection and human motion categorization.

Course Code:	STAT361
Course Name:	Operational Research I
Credit:	3 Credit (3 Hrs. Lectures and 0 Hrs. Lab)
Prerequisite:	STAT319

Problem-solving and decision making. Linear programming: formulation, the graphical method, the simplex method, sensitivity analysis, and duality. Transportation and assignment problem. Integer programming. Project scheduling PERT/CPM.

Course Code:	SENG491
Course Name:	Selected Topic-II
Credit:	3 Credit (3 Hrs. Lectures and 0 Hrs. Lab)
Prerequisite:	None

An application-oriented introduction to cloud computing. Basics of Service Oriented Architectures (SOA). Basic concepts of cloud computing such as virtualization and the service layers IaaS, PaaS and SaaS, dynamic provisioning, and elasticity. Practical use of available public and private cloud stacks. Introduction to cloud security. Task-based programming in cloud environments, distributed task queues such as Celery. Message brokers such as RabbitMQ.