COMSATS University Islamabad

Registrar Secretariat, Academic Unit (PS)

*****

No. CUI-Reg/Notif- 4756/21/3431 December 17, 2021

NOTIFICATION

Scheme of Studies of Bachelor of Science in Software Engineering BS (SE)

Academic Council in its 32nd meeting held on October 06, 2021, on recommendations of 28th meeting of Board of Faculty of Information Sciences and Technology, approved revised Scheme of Studies of Bachelor of Science in Software Engineering BS (SE) effective from Spring 2022 at CUI System:

Nomenclature: Bachelor of Science in Software Engineering BS (SE)

1. Minimum Duration in year: 04 Years
2. Minimum No. of Semesters: 08

3. **Course Work**	**(Min No. of Courses)**	**(Min No. of Credit Hours)**
Area Covered in BS (SE)		
a) Computing Core Courses	11	39
b) Mathematics & Science Foundation Courses	04	13
c) General Education Courses	07	21
d) University Elective Courses	04	12
Domain Courses (List Attached)		
a) Software Engineering Core Courses	08	24
b) Software Engineering Elective Courses	05	15
c) Software Engineering Supporting Courses	03	09
Minimum No. of Courses Required:	**42**	--
Minimum No. of Credit Hours Required:		**133**

Note:

1. CSE350-Topics in Software Engineering - I and CSE483-Topics in Software Engineering - II may be allowed to offer upon getting prior approval of the course contents from the Head of Department (HoD).
2. The Regulations relating to Undergraduate Degree Programs approved by the Competent Authority and amended from time to time shall be applicable.

Muniba Nasir

Muniba Nasir
Additional Registrar

Encl: (Total 60 pages including this page)

Distribution:

1. All Campus Directors, CUI
2. Dean, Faculty of Information Sciences and Technology, CUI
3. Controller of Examinations, CUI
4. Chairperson, Department of Computer Science, CUI
5. Incharge QEC/CU Online, PS
6. All HoDs/Incharge of Academics/Examinations Sections, CUI Campuses
7. Internal distributions, Registrar Office (Academic Unit), CUI

CC:

1. PS to Rector CUI
2. PS to Registrar CUI

Computing Core Courses

S. No	Course Code	Course Title	Credit Hours	Pre-requisite (s)
1.	CSC103	Programming Fundamentals	4(3,1)	-
2.	CSC241	Object Oriented Programming	4(3,1)	CSC103
3.	CSC102	Discrete Structures	3(3,0)	-
4.	CSC211	Data Structures and Algorithms	4(3,1)	CSC103
5.	CSC291	Software Engineering Concepts	3(3,0)	-
6.	CSC323	Principles of Operating Systems	4(3,1)	CSC211
7.	CSC340	Computer Networks	4(3,1)	-
8.	CSC270	Database Systems	4(3,1)	CSC211
9.	CSC432	Information Security	3(3,0)	-
10.	CSE498	Senior Design Project I	2(0,2)	CSC270, CSC291, HUM102, CSC241
11.	CSE499	Senior Design Project II	4(0,4)	CSE498

Mathematics and Science Foundation Courses

S. No	Course Code	Course Title	Credit Hours	Pre-requisite (s)
1.	MTH104	Calculus and Analytic Geometry	3(3,0)	-
2.	MTH231	Linear Algebra	3(3,0)	-
3.	MTH262	Statistics and Probability Theory	3(3,0)	-
4.	PHY121	Applied Physics for Engineers	4(3,1)	-

General Education Courses

S. No	Course Code	Course Title	Credit Hours	Pre-requisite (s)
1.	CSC101	Introduction to ICT	3(2,1)	-
2.	CSC410	Professional Practices	3(3,0)	-
3.	HUM100	English Comprehension and Composition	3(3,0)	-
4.	HUM102	Report Writing Skills	3(3,0)	HUM100
5.	HUM103	Communication Skills	3(3,0)	HUM100
6.	HUM110	Islamic Studies **	3(3,0)	-
7.	HUM111	Pakistan Studies	3(3,0)	-

**Non-Muslim students can opt for HUM114 Ethics 3(3,0) course in lieu of HUM110 Islamic Studies, if they intend to.

Munibe nbasip

Software Engineering Core Courses

S. No	Course Code	Course Title	Credit Hours	Pre-requisite (s)
1.	CSC336	Web Technologies	3(2,1)	CSC241
2.	CSE302	Software Quality Engineering	3(3,0)	CSC291
3.	CSE303	Software Design and Architecture	3(2,1)	CSC291
4.	CSE305	Software Requirement Engineering	3(3,0)	CSC291
5.	CSE325	Software Construction and Development	3(3,0)	CSE303
6.	CSE327	Software Re-Engineering	3(3,0)	-
7.	CSC356	Human Computer Interaction	3(2,1)	-
8.	CSE494	Software Project Management	3(3,0)	CSC291

Software Engineering Supporting Courses (Any Three Courses)

S. No	Course Code	Course Title	Credit Hours	Pre-requisite (s)
1.	CSE356	Formal Methods	3(3,0)	CSC291
2.	CSE357	Business Process Engineering	3(3,0)	-
3.	CSC451	Introduction to Modeling and Simulation	3(2,1)	CSC211
4.	CSC456	Stochastic Processes	3(3,0)	-
5.	MTH467	Operations Research	3(3,0)	-

Software Engineering Electives (Any Five Courses)

S. No	Course Code	Course Title	Credit Hours	Pre-requisite (s)
1.	CSC303	Mobile Application Development	3(2,1)	CSC241
2.	CSC412	Visual Programming	3(2,1)	CSC241
3.	CSC337	Advanced Web Technologies	3(2,1)	CSC336
4.	CSC417	E-Commerce and Digital Marketing	3(2,1)	-
5.	CSC418	DevOps for Cloud Computing	3(2,1)	-
6.	CSE300	Software Metrics	3(3,0)	CSC291
7.	CSE331	Software Engineering Economics	3(3,0)	-
8.	CSE332	Information System Audit	3(3,0)	-
9.	CSE333	Software Process Improvement	3(3,0)	-
10.	CSE334	Reverse Engineering of Source Code	3(2,1)	-
11.	CSE344	Semantic Web	3(2,1)	-
12.	CSE350	Topics in Software Engineering I	3(3,0)	-
13.	CSE354	Design Patterns	3(2,1)	-
14.	CSE360	Software Safety Critical Systems	3(3,0)	-
15.	CSE361	Software Fault Tolerance	3(3,0)	-
16.	CSE483	Topics in Software Engineering II	3(3,0)	-
17.	CSC325	Computer Organization & Assembly Language	4(3,1)	
18.	CSC331	Digital Image Processing	3(3,0)	MTH231

Munibe Nasir

19.	CSC334	Parallel and Distributed Computing	3(2,1)	CSC323
20.	CSC353	Computer Graphics	3(2,1)	MTH231
21.	CSC354	Machine Learning	3(3,0)	-
22.	CSC402	Database Systems II	3(3,0)	CSC270
23.	CSC454	Pattern Recognition	3(3,0)	
24.	CSC461	Introduction to Data Science	3(3,0)	MTH262
25.	CSC462	Artificial Intelligence	4(3,1)	CSC102
26.	CSC471	Distributed Database Systems	3(3,0)	CSC270
27.	CSC495	Game Development	4(3,1)	CSC241
28.	CSC497	Data Warehousing and Data Mining	3(2,1)	CSC270
29.	CSC448	Data Visualization	3(3,0)	-
30.	CSC455	Computer Vision	3(3,0)	
31.	CSC433	Cryptography and Network Security	3(3,0)	CSC340
32.	CSE482	Automated Software Testing	3(2,1)	

Note: *CSE350* and *CSE483 can be offered with the approval of the Head of Department. However, the contents of these courses must reflect the recent industrial practices.*

University Electives

S. No	Course Code	Course Title	Credit Hours	Pre-requisite (s)
1.	MGT100	Introduction to Business	3(3,0)	-
2.	MGT101	Introduction to Management	3(3,0)	-
3.	MGT131	Financial Accounting	3(3,0)	-
4.	MGT210	Fundamentals of Marketing	3(3,0)	-
5.	MGT350	Human Resource Management	3(3,0)	-
6.	MGT513	New Product Development	3(3,0)	-
7.	ECO300	Engineering Economics	3(3,0)	-
8.	ECO400	Business Economics	3(3,0)	-
9.	ECO403	Managerial Economics	3(3,0)	-
10.	ECO111	Principles of Microeconomics	3(3,0)	-
11.	ECO484	Project Planning and Monitoring	3(3,0)	-
12.	HUM220	Introduction to Psychology	3(3,0)	-
13.	HUM221	International Relations	3(3,0)	-
14.	HUM320	Introduction to Sociology	3(3,0)	-
15.	HUM430	French	3(3,0)	-
16.	HUM431	German	3(3,0)	-
17.	HUM432	Arabic	3(3,0)	-
18.	HUM433	Persian	3(3,0)	-
19.	HUM434	Chinese	3(3,0)	-
20.	HUM435	Japanese	3(3,0)	-

Munib Nasir

Tentative Study Plan for BS (SE)

Below is a tentative eight semester study plan of course offerings. A campus may change the offerings depending upon their available resources.

Semester – 1				
S#	**Course Code**	**Course Title**	**Credit Hours**	**Pre-requisite(s)**
1	CSC101	Introduction to ICT	3(2, 1)	
2	HUM100	English Comprehension and Composition	3(3, 0)	
3	HUM110	Islamic Studies	3(3, 0)	
4	HUM111	Pakistan Studies	3(3, 0)	
5	PHY121	Applied Physics for Engineers	4(3, 1)	
6	MTH100	Mathematics I*	3(3, 0)	

Semester – 2				
S#	**Course Code**	**Course Title**	**Credit Hours**	**Pre-requisite(s)**
1	CSC103	Programming Fundamentals	4(3, 1)	
2	HUM102	Report Writing Skills	3(3, 0)	HUM100
3	CSC291	Software Engineering Concepts	3(3, 0)	
4	CSC102	Discrete Structures	3(3, 0)	
5	MTH101	Calculus 1*	3(3, 0)	
6		University Electives 1/4		

Semester – 3				
S#	**Course Code**	**Course Title**	**Credit Hours**	**Pre-requisite(s)**
1	CSC241	Object Oriented Programming	4(3, 1)	CSC103
2	CSE302	Software Quality Engineering	3(3, 0)	CSC291
3	MTH231	Linear Algebra	3(3, 0)	
4	MTH104	Calculus and Analytic Geometry	3(3, 0)	
5		University Electives 2/4		

Semester – 4				
S#	**Course Code**	**Course Title**	**Credit Hours**	**Pre-requisite(s)**
1	CSC211	Data Structures and Algorithms	4(3, 1)	CSC103
2	CSC340	Computer Networks	4(3, 1)	
3	CSE303	Software Design and Architecture	3(2, 1)	CSC291
4	HUM103	Communication Skills	3(3, 0)	HUM100
5	MTH262	Statistics and Probability Theory	3(3, 0)	

		Semester – 5		
S#	**Course Code**	**Course Title**	**Credit Hours**	**Pre-requisite(s)**
1	CSC270	Database Systems	4(3, 1)	CSC211
2	CSC323	Principles of Operating Systems	4(3, 1)	CSC211
3	CSC410	Professional Practices	3(3, 0)	
4	CSE305	Software Requirement Engineering	3(3, 0)	CSC291
5		Software Engineering Supporting Courses 1/3		
6		Software Engineering Elective Courses 1/5		

Semester – 6				
S#	**Course Code**	**Course Title**	**Credit Hours**	**Pre-requisite(s)**
1	CSE325	Software Construction and Development	3(3, 0)	CSE303
2	CSE327	Software Re-Engineering	3(3, 0)	
3	CSC336	Web Technologies	3(2, 1)	CSC241
4	CSC432	Information Security	3(3, 0)	
5		Software Engineering Elective Courses 2/5		
6		Software Engineering Elective Courses 3/5		

Semester – 7				
S#	**Course Code**	**Course Title**	**Credit Hours**	**Pre-requisite(s)**
1	CSC356	Human Computer Interaction	3(2, 1)	
2	CSE494	Software Project Management	3(3, 0)	CSC291
3	CSE498	Senior Design Project I	2(0, 2)	CSC270, CSC291, HUM102, CSC241
4		Software Engineering Supporting Courses 2/3		
5		Software Engineering Elective Courses 4/5		

Semester – 8				
S#	**Course Code**	**Course Title**	**Credit Hours**	**Pre-requisite(s)**
1	CSE499	Senior Design Project II	4(0, 4)	CSE498
2		University Electives 3/4		
3		University Electives 4/4		
4		Software Engineering Supporting Courses 3/3		
5		Computer Science Elective Courses 5/5		

* Non-Credit course. Students with Pre-Medical background must have to pass deficiency courses of Mathematics (MTH100 and MTH101) of 6 credit hours within one year.

Course Code: CSC103 **Pre-Requisite:** None

Course Title: Programming Fundamentals

Credit Hours: 4(3, 1)

Course Objectives:

- To introduce various programming language paradigms;
- To develop the skills to analyze, design, test and translate problems into computer programs;
- To present the fundamental programming concepts, including basic type system;
- To demonstrate basic coding, testing and debugging techniques;
- To provide an implementation of the concepts.

Course Contents:

This course emphasis the basic concepts used in programming. The topics include: Computer Programming; Basic Syntax & Semantics of a Higher-Level Language; Conditional & Iterative Control Structures; Functions & Parameter Passing; Recursion; Arrays; String Processing; Exception Handling; Refactoring; Debugging; Modern Programming Environments; Testing Fundamentals; and File I/O.

Recommended Books:

1. Java How to Program, Deitel, P. & Deitel, H., Prentice Hall, 2019.
2. Java: The Complete Reference, Herbert Schildt, Prentice Hall, 2018.
3. Introduction to Java Programming and Data Structures, Comprehensive Version, Y.D.Liang, Pearson, 2017.
4. Java: Programming Basics for Absolute Beginners, Nathan Clark, CreateSpace Independent Publishing Platform, 2017.

Course Code: CSC241 **Pre-Requisite:** CSC103

Course Title: Object Oriented Programming

Credit Hours: 4(3, 1)

Course Objectives:

- To introduce the object oriented programming paradigm;
- To teach in depth the philosophy of object-oriented design and concepts of encapsulation, abstraction, inheritance and polymorphism;
- To develop understanding of sub typing and generic types;
- To explain the usage of library components;
- To develop code that responds to exception conditions raised during execution;
- To develop understanding of event handlers for use in reactive systems, such as GUIs;
- To demonstrate implementation of the concepts.

Course Contents:

This course emphasizes the concepts of object-oriented techniques used in developing computer-based system. The topics include: Overview of Object-Oriented Programming; Classes & its Concepts; Problem Solving in Object Oriented Paradigm; Inheritance; Polymorphism; Library Components; Object Oriented Concepts of File Handling; Swing Classes; Events & Event Handlers; and Canonical Uses.

Recommended Books:

1. Introduction to Java Programming and Data Structures, Comprehensive Version, Y. Liang, Y. Daniel Liang, Pearson, 2019.
2. Concise Guide to Object-Oriented Programming, Kingsley Sage, Springer, 2019.
3. Absolute Java, Savitch, W. & Mock, K., Pearson, 2016.

Course Code: CSC102 **Pre-Requisite:** None

Course Title: Discrete Structures

Credit Hours: 3(3, 0)

Course Objectives:

- To teach important discrete data structures such as sets, relations, functions, graph and trees;
- To introduce a formal system (propositional and predicate logic) on which mathematical reasoning is based;
- To thoroughly train in the construction and understanding of mathematical proofs;
- To exercise common mathematical arguments and proof strategies;
- To develop the ability to see a problem from a mathematical perspective.

Course Contents:

This course introduces mathematical structures necessary for the development of program logic. It covers the following topics: Set Theory; Propositional & First Order Logic; Rules of Inference; Mathematical Proofs; Counting & Probability; Graphs & Tree Structures; and Discrete Probability.

Recommended Books:

1. Discrete Mathematics with Applications, Susanna S.E., Cengage Learning, 2019.
2. Discrete Mathematics and Its Applications, Rosen, K. H., McGraw Hill, 2018.
3. Discrete Mathematics, John, D., Pearson, 2017.

Course Code: CSC211 **Pre-Requisite:** CSC103

Course Title: Data Structures and Algorithms

Credit Hours: 4(3, 1)

Course Objectives:

- To discuss the issues of time complexity and examine various algorithms from this perspective;
- To introduce the concept and usage of data structures through abstract data structures, including linked lists, stacks, queues, priority queue, trees, and graphs;
- To implement above data structures and their applications;
- Develop an understanding of recursion as they apply to trees and graphs;
- To introduce the concept of memory management and garbage collection.

Course Contents:

This course provides fundamental knowledge of data organization. The topics include: Overview of Data Structures; Static & Dynamic List; Stack; Queue; Tree & its Algorithms; Graph & its Algorithms; Sorting; Searching; Hashing; and Time Complexity of an Algorithm.

Recommended Books:

1. A Common-Sense Guide to Data Structures and Algorithms, Jay Wengrow, Pragmatic Bookshelf, 2020.
2. Data Structures and Algorithm Analysis in C++, Mark Allen Weiss, Addison-Wesley, 2014.

Course Code: CSC291 **Pre-Requisite:** None

Course Title: Software Engineering Concepts

Credit Hours: 3(3, 0)

Course Objectives:

- Introduce the different software process models by illustrating its phases;
- Develop awareness of using different tools and environment supported in software engineering;
- Develop basic understanding of requirement engineering to gather requirements for developing a system;
- Create design of a system by understanding its core concepts;
- Construct the system by understanding different coding techniques;
- Introduce the concepts of verification and validation.

Course Contents:

This course introduces the different software process models by illustrating its phases and principles of software engineering. Topics include Overview of Software Engineering; Software Process Models; Requirement Engineering Concepts; Software Design; Design Modeling; Software Quality Engineering; Software Project Management; Software Maintenance and Software Evolution.

Recommended Books:

1. Software Engineering: A Practitioner's Approach, Roger S. Pressman & Bruce R. Maxim, McGraw-Hill, 2020.
2. Engineering Software Products: An Introduction to Modern Software Engineering, Ian Sommerville, Pearson Education Limited, 2021.
3. Software Engineering, Ian Sommerville, Pearson Education Limited, 2016.
4. Software Engineering with UML, Bhuyan Unhelkar, CRC Press, 2018.

Course Code: CSC323 **Pre-Requisite:** CSC211

Course Title: Principles of Operating Systems

Credit Hours: 4(3, 1)

Course Objectives:

- To discuss the services provided by, and the design of an operating system;
- To explain the structure and organization of the file system and memory management;
- To discuss what a process is and how processes are synchronized and scheduled as well as how access to system resources is managed;
- To present the use of system calls for managing processes, memory and the file system;
- To explain the data structures and algorithms used to implement an OS;
- To explain security and protection issues in computer systems;
- To use C and UNIX commands to develop various system programs under Linux to make use of OS concepts related to process synchronization, shared memory, mailboxes, file systems, etc.

Course Contents:

This course introduces the services and functions performed by operating system for smooth and accurate system operations. Topics include: Operating Systems Overview; Device Organization & System Operations; Operating Systems Principles; Process Management; Process Synchronization; Deadlocks; Multiprocessor Issues; Memory Management; Storage Management; and Security & Protection.

Recommended Books:

1. Operating System Concepts, Silberschatz & Galvin, Addison-Wesley, 2021.
2. Operating Systems: Internals and Design Principles, Stallings, W., Pearson, 2017.
3. Modern Operating Systems, Tanenbaum, A. S., Prentice Hall, 2014.

Course Code: CSC340 **Pre-Requisite:** None

Course Title: Computer Networks

Credit Hours: 4(3, 1)

Course Objectives:

- To discuss the network components, services and technologies;
- To describe the layered architecture of network protocols (e.g. TCP/IP) and explains core functions of each layer including addressing, routing, internetworking, switching, multiplexing, error and flow control, medium access and coding, Wireless and mobile networks;
- To discuss threats to network security and design of secure networks;
- To develop an understanding with the implementation of fundamental concepts of networking.

Course Contents:

This course introduces the concepts of computer networks along with communication standards and protocols. Topics include: Introduction; Physical Components; Internet Backbones; Layered Architecture; Application Layer Services & Protocols; Transport Layer Services; Transport Layer Protocols; Network Layer; The Internet Protocol; Routing Algorithms; Link Layer; Error Detection Techniques; MAC Protocols; Physical Layer; Transmission Impairment; Wireless & Mobile Networks; Cellular Networks; and Security in Computer Networks.

Recommended Books:

1. Computer Networking: A Top-Down Approach, James F. Kurose, Keith Ross Pearson, 2021.
2. Data Communications and Networking with TCP/IP Protocol Suite, Behrouz A. Forouzan, McGraw-Hill, 2021.

Course Code: CSC270 **Pre-Requisite:** CSC211

Course Title: Database Systems

Credit Hours: 4(3, 1)

Course Objectives:

- To explain the basic database concepts, information retrieval and relational theory;
- To develop the relational data model;
- To develop an enterprise data model that reflects the organization's fundamental business rules;
- To apply normalization techniques;
- To discuss the basics of transaction management, concurrency controls, query mechanisms, security and quality issues;
- To use and apply database programming languages and physical database design to gain experience in term project.

Course Contents:

This course introduces the fundamental concepts of database systems. Topics include: Introduction to Databases & Information Systems; Evolution of Database Systems; Components; Architecture; Functions; Relational Model; Relational Algebra; Relational Calculus; Data Modeling; Relational Data Model; Relational Algebra & Calculus; Integrity Constraints; Conceptual Models; Entity-Relationship (E-R) Model; Enhanced E-R Model; Mapping Conceptual Schema to Relational Schema; Functional Dependency & Normalization; Structured Query Language (SQL); Views; Materialized Views; Non-Relational/No SQL Databases; MongoDB as NoSQL Database; Document Model; and Transaction Management.

Recommended Books:

1. MongoDB: The Definitive Guide, Shannon Bradshaw, Eoin Brazil, Kristina Chodorow, O'Reilly Media, 2019.
2. Database System Concepts, Silberschatz, Korth, Sudarshan, McGraw Hill, 2019
3. Fundamentals of Database Systems, Elmasri, R, Navathe, Pearson, 2016.
4. Database systems: A Practical Approach to Design, Implementation, And Management, Thomas Connoll y, Carolyn Begg, Pearson, 2015.

Course Code: CSC432 **Pre-Requisite:** None

Course Title: Information Security

Credit Hours: 3(3, 0)

Course Objectives:

- To provide familiarity with prevalent network and distributed system attacks, defenses against them, and forensics to investigate the aftermath;
- To develop an understanding of cryptography, how it has evolved, and some key encryption techniques used today;
- To develop an understanding of security policies (such as authentication, integrity and confidentiality), as well as protocols to implement such policies in the form of message exchanges.

Course Contents:

This course introduces the concepts and applications of information security. Topics include: Information Security Overview; Threats & Attacks; Legal & Professional Issues; Security Planning; Risk Analysis; Security Technology; Cryptography; Confidentiality; Authentication Models; Operational Security; and Implementation & Maintenance.

Recommended Books:

1. Introduction to Computer Security, Goodrich, M., & Tamassia, R., Pearson, 2021.
2. Principles of Information Security, Michael E., Whitman & Mattord, H. J., Cengage Learning, 2017.
3. Security in Computing, Pfleeger, C.P., Pfleeger, S.L. & Margulies, J., Prentice Hall, 2015.

Course Code: CSE498 **Pre-Requisites:** HUM102, CSC241, CSC291 & CSC270

Course Title: Senior Design Project I

Credit Hours: 2(0, 2)

Course Objectives:

- To employ the knowledge gained from courses throughout the program such as development of requirements, designing and documentation;
- To develop the project plan, software requirement specification document and software design document for a complex real world problem;
- To enhance communication, presentation and writing skills.

Course Contents:

This course is designed as a capstone project which requires students to demonstrate technical and presentation skills at levels which are commensurate with professional software engineering practices. It is desirable that students apply their knowledge of computing throughout the course such as development of requirements, design, implementation, and quality assurance to develop a software solution to a real-world problem from conception to completion. In this part, students propose a practically useful project (by writing the scope document) and develop software requirement specification document & software design document.

Recommended Books:

Books will be recommended by the faculty member supervising the capstone project

Course Code: CSE499 **Pre-Requisite:** CSE498

Course Title: Senior Design Project II

Credit Hours: 4(0, 4)

Course Objectives:

- To implement the design produced in CSE498 along with testing and evaluation of a complex real-world project in the area of Software Engineering;
- To enhance presentation, communication and technical writing skills;
- To establish the ability to become an effective team player.

Course Contents:

The Final Year Project is a prominent element of computing degree program and is central to the development of students' professional competencies. This is the second part of a two-semester, final-year capstone project. Student teams employ knowledge gained from courses throughout the program such as the development of requirements, design, implementation, and quality assurance to develop a software solution to a real-world problem from conception to completion. In this part, students implement the design they produced in CSC498, test their code, and evaluate their final product.

Recommended Books:

Books will be recommended by the faculty member supervising the capstone project

Course Code: CSC101 **Pre-Requisite:** None

Course Title: Introduction to ICT

Credit Hours: 3(2, 1)

Course Objectives:

- To provide basic understanding of Information and Communication Technologies (ICTs);
- Discuss the four main functions of computer hardware: input, processing, output, and storage;
- Identify and describe major hardware components;
- Develop understanding of the basics of storage devices, number systems, machine cycle, and microcomputer processor;
- Identify, describe and use communications and networking terminology further include Internet operations and its uses;
- Describe the major operating system functions and demonstrate usage of operating system services;
- Explain programming and application software;
- Discuss databases and e-commerce concepts;
- Understanding of IT security and other related issues.

Course Contents:

This course covers the basics of Information and Communications Technologies. Topics include: Overview of ICT; Computing Models; Computer Systems & Components; Number Systems & Computer Codes; System & Application Software; Introduction to Databases & Information Systems; Computer Networks & Internet; Security; Future trends in ICT; Problem Solving Concepts; Program Development Lifecycle; and Introduction to Python.

Recommended Books:

1. Python Basics: A Practical Introduction to Python 3, David Amos, Dan Bader, Joanna Jablonski, and Fletcher Heisler, Real Python, 2021.
2. Understanding Computers: Today and Tomorrow, Comprehensive, Deborah Morley, Charles S. Parker, Cengage Learning, 2017.
3. Foundations of Computer Science, Behrouz Forouzan, McGraw-Hill, 2017.
4. Starting Out with Python, Tony Gaddis, Addison-Wesley, 2016.
5. Problem Solving & Programming, Maureen Sprankle, Jim Hubbard, Prentice Hall, 2012.

Course Code: CSC410 **Pre-Requisite:** None

Course Title: Professional Practices

Credit Hours: 3(3, 0)

Course Objectives:

- Develop an understanding of the basic cultural, social, legal, and ethical issues inherent in the discipline of Computing;
- Highlighting the use and significance of professional ethics;
- Discuss intellectual property and privacy rights;
- To professionally communicate and evaluate formal documents;
- Explain the consequences of computing on individuals, organizations, and society.

Course Contents:

This course covers the following topics: Introduction to Ethics; Social Implications of Computing & Networked Communications; Intellectual Property; Information Privacy; Privacy & the Government; Computer & Network Security; Computer Reliability; Professional Ethics; and Work & Wealth.

Recommended Books:

1. Ethics in Information Technology, Reynolds, G., Cengage Course Technology, 2018.
2. Ethical and Social Issues in Information Age, Kizza J. M., 5th Edition, Springer-Verlag, 2017.
3. A Gift of Fire, Social, Legal, and Ethical Issues for Computing Technology, Baase, S., Pearson Inc, 2017.
4. Ethics for the Information Age, Quinn, M.J., 5th Edition, Pearson Education, 2016.

Course Code: CSE305 **Pre-Requisite:** CSC291

Course Title: Software Requirement Engineering

Credit Hours: 3(3, 0)

Course Objectives:

- To understand the basics of requirements engineering;
- To understand activities in requirements engineering (requirements elicitation, analysis and negotiation, validation, and management).
- To understand the requirements modeling and requirements engineering methods;
- To understand functional and non-functional requirements;
- To understand requirement management and requirement engineering for agile development;
- To know how to apply the learnt concepts, knowledge and techniques to solve real world problems;

Course Contents:

The focus of this course is how to find and collect requirements from relevant sources, both at the start and during software development. Topics include Software Requirements Engineering; Usage of Tools for RE Processes; Requirements Elicitation; Understanding User Requirements; Traditional and Agile Approaches to Define User Requirements; Functional and Non-Functional Requirements; Requirements Modeling; Documenting the Requirements; Requirements Validation; Requirements Engineering for Agile Methodologies and Requirements Management.

Recommended Books:

1. Engineering Software Products: An Introduction to Modern Software Engineering, Ian Sommerville, Global Edition, Pearson Education Limited, 2021.
2. Requirements Engineering for Software and Systems, Phillip A. Laplante, Auerbach Publications, 2017.
3. Requirements Engineering and Management for Software Development Projects, Chemuturi M., Springer New York, 2013.
4. Software Requirements, Wiegers K. &Beatty J., Microsoft Press, 2013.
5. Visual Models for Software Requirements, Beatty J. &Chen A., Mocrosoft Press, 2012.
6. Requirements Engineering, Hull E., Ken Jackson K. & DickJ. ,Springer-Verlag, 2011.
7. Software & Systems Requirements Engineering: In Practice, Berenbach B., Paulish D. J., Kazmeier J. & Rudorfer A., McGraw Hill, 2009.

Course Code: CSE302 **Pre-Requisite:** CSC291

Course Title: Software Quality Engineering

Credit Hours: 3(3, 0)

Course Objectives:

- To define the skills and knowledge necessary to perform software quality engineering tasks;
- To determine how to evaluate software quality activities and processes and determine whether they meet their intended purpose;
- To introduce software testing as a primary means to ensure software quality;
- To introduce measurement and the techniques used to build and check quality in software systems;
- To discuss quantitative assessment of software quality, quality controls,

Course Contents:

This course is designed to teach best practices of software quality engineering. Topics include: Overview of Software Quality; Challenges; Software Quality Factor Models; SQA Organization; SQA Process Implementation Activities; Product Assurance Activities for Conformance; Process Assurance Activities for Conformance; and Quality Improvement Models.

Recommended Books:

1. Software Quality: Concepts and Practice, Daniel Galin, John Wiley & Sons, 2018.
2. Software Quality Engineering: A Practitioner's Approach, Suryn W, John Wiley & Sons, 2014.
3. Software Process Definition and Management, Jürgen Münch, Ove Armbrust, Martin Kowalczyk, Martín Soto, Springer, 2012.
4. Mastering Software Quality Assurance: Best Practices, Tools and Techniques for Software Developers Chemuturi, M. J, Ross Publishing, 2010.

Course Code: CSE303 **Pre-Requisite:** CSC291

Course Title: Software Design and Architecture

Credit Hours: 3(2, 1)

Course Objectives:

- To provides knowledge on various aspects of software design;
- To apply suitable architectural styles;
- To exercise appropriate software design patterns;
- To express the specifications and design of an application using UML.

Course Contents:

This course provides understanding towards software design, architecture styles and design patterns. Topics include: Software Design Principles & Processes; Software Architectures; Middleware Architecture; Service Oriented Architecture; Micro Services Architecture; Software Architecture Processes & Documentation; Plan Driven Software Design; Designing with Patterns; and Components & Services.

Recommended Books:

1. Software Design: Creating Solutions for ill Structured Problems, Budgen, D., CRC Press, 2021.
2. Engineering Software Products: An Introduction to Modern Software Engineering, Sommerville, I., Global Edition Pearson Education, 2020.
3. Software Architecture in Practice, Bass L., Clements P. & Kazman R., Addison-Wesley, 2013.
4. Essential Software Architecture, Gorton, I., Springer – Verlag, 2011.
5. Software Architecture and Design Illuminated, Qian, K., Fu, X., Tao, L., & Xu, C., Jones & Bartlett Learning, MA, 2009.

Course Code: CSC356 **Pre-Requisite:** None

Course Title: Human Computer Interaction

Credit Hours: 3(2, 1)

Course Objectives:

- To explain the human factors to be considered in the design of human computer interaction;
- To define different processes for designing interfaces for different contexts;
- To define and implement user-centered approach in software development process and apply suitable techniques for collecting user requirement and analyzing tasks;
- To discuss the evaluation and comparison of user interfaces using different techniques such as laboratory experiments and expert reviews;
- To apply different techniques learned throughout the course on a practical project.

Course Contents:

This course covers the fundamental principles and methods related to Human-Computer Interaction (HCI). Topics include: Overview; Universal Design; PACT Analysis; Evaluation Measures; Conceptualizing Interaction; Data Gathering Techniques; Process for Human Centered Development; Evaluation with & without Users; Cognitive & Social Aspects; Interaction Technologies; and Case Studies.

Recommended Books:

1. Laws of UX: Using Psychology to Design Better Products & Services, Yablonksi, O'Reilly Media, 2020.
2. Interaction Design beyond Human Computer Interaction, Sharp, H Preece, J. Rogers, Wiley, 2019.
3. Designing Interfaces: Patterns for Effective Interaction Design, Tidwell, Brewer, Valencia, O'Reilly Media, 2019.
4. Designing the User Interface: Strategies for Effective Human-Computer Interaction, Shneiderman, Catherine Plaisant, Pearson, 2018.
5. The Design of Everyday Things: Revised and Expanded Edition, Norman D, Basic Books, 2014.

Course Code: CSE494 **Pre-Requisite:** CSC291

Course Title: Software Project Management

Credit Hours: 3(3, 0)

Course Objectives:

- To discuss different software project management phases;
- To prepare a project plan for a software project that includes estimates of size and effort, a schedule, resource allocation, configuration control, change management, and project risk identification and management;
- To compare different methods and techniques used to assure the quality of a software product;
- To explain an approach to risk that will help to secure the on-time delivery of software;
- To demonstrate the use of the MS-project as a tool for software project management.

Course Contents:

This course covers fundamental concepts of software project management. Topics include: Software Project Management; Managing Project Goals, Time & Costs; Risk Management; Quality Management; HR & Communication Management; Software Project Pricing; Software Development Management; and Development & Management Standards.

Recommended Books:

1. A Guide to the Project Management Body of Knowledge, PMBOK® Guide, PMI, 2017.
2. Introduction to Software Project Management, Adolfo Villafiorita, CRC Press, 2014.
3. Software Extension to the PMBOK® Guide, PMI, 2013.
4. PMI Agile Practice Guide, PMI, 2017.

Course Code: CSE325 **Pre-Requisite:** CSE303

Course Title: Software Construction and Development

Credit Hours: 3(3, 0)

Course Objectives:

- To understand the role of design and its major activities within the OO software development process, with focus on the Unified process
- To develop Object-oriented design models and refine them to reflect implementation details
- To evaluate different architectures for a medium size software.
- To implement design model using an object-oriented programming language.

Course Contents:

This course provides the concepts of software design and implementation. Topics Include: Software Construction; Managing Construction; Construction Practical Considerations; Configuration Management & Integration; Code Improvement; Structuring Concurrent Applications; Concurrency Pitfalls & Testing; Performance & Patterns; Non-blocking Algorithms; and Test First Programming & Exception Handling.

Recommended Books:

1. Clean Code: A Handbook of Agile Software Craftsmanship, Robert C. Martin, Prentice Hall, 2008.
2. Java Concurrency in Practice, Brian Goetz, Tim Peierls, Joshua Bloch, Joseph Bowbeer, David Holmes, Doug Lea, Addison-Wesley Professional, 2006.

Course Code: CSE327 **Pre-Requisite:** None

Course Title: Software Re-Engineering

Credit Hours: 3(3, 0)

Course Objectives:

- To explain the concepts and technique of software re-engineering.
- To apply reengineering techniques to maintain and modify software systems
- To analyze and understand maintenance related problems associated with object oriented software systems.
- To perform complex design reengineering and reverse engineering problems.

Course Contents:

This course provides the concepts and application of re-engineering techniques. Topics include: Introduction to Software Re-Engineering; Software Evolution & Legacy Systems; Re-Engineering Techniques; Refactoring & Applications; Re-Architecting; Big Rewrite; Project Improvement & Automating the Development Environment; Object Oriented Re-Engineering Patterns; Quality Issues; Tool Support; Challenges & Stakeholder Aspiration; Software Maintenance; and Re-Engineering Economics.

Recommended Books:

1. Re-Engineering Legacy Software, David Lorge Parnas, Chris Birchall, Manning publications, 2016.
2. Re-Engineering, Priyadarshi Tripathy, Kshirasagar Naik, John Wiley & Sons, Inc, 2015.

Course Code: CSC336 **Pre-Requisite:** CSC241

Course Title: Web Technologies

Credit Hours: 3(2, 1)

Course Objectives:

- To explain the fundamental concepts of web architectures and its applications;
- To provide an understanding of Search Engine Optimization (SEO);
- To provide an understanding of planning, designing and publishing a multi-page website;
- To provide hands-on experience of client-side technologies such as HTML, JavaScript, CSS;
- To provide practical experience of development of dynamic clients using modern development technologies, for example PHP, AJAX, MySQL.

Course Contents:

This course introduces the modern web technologies used for the web development. Topics include: Overview of Web Platforms; Web Architectures; Markup Languages; Styling; Client-Side Scripting Languages; Server-Side Technologies; Use of Databases in Web-based Applications; Web APIs; Programming under Platform Constraints; Security Issues; and Web Hosting.

Recommended Books:

1. Web Engineering, Sahil Rai, Kuk University Notes, 2020.
2. Web Design Playground: HTML & CSS the Interactive Way, Paul McFedries, Manning, 2019.
3. Laravel Up and Running, A Framework for Building Modern PHP Apps, Matt. Stauffer, Oreilly, 2019.
4. Beginning PHP and MySQL: From Novice to Professional, Frank M. Kromann, Apress, 2018.
5. Web Programming with HTML5, CSS, and JavaScript, John Dean, Jones & Bartlett Learning 2018.

Course Code: CSE356 **Pre-Requisite:** CSC291

Course Title: Formal Methods

Credit Hours: 3(3, 0)

Course Objectives:

- To understand software lifecycle development models;
- To understand in depth algebraic specification;
- To understand formal methods of specifying and verifying software.

Course Contents:

This course provides an insight about the use of formal representations during the software development process. Topics include: Introduction to Formal Methods; Regular Expressions and Languages; Finite State Machines; Propositional Logic; Predicate Logic; Temporal Logic; Formal Verification; Petri Nets; Formal Testing; Specification-Based Testing; Implementation-Based Testing; and V&V Comparison.

Recommended Books:

1. Formal Methods in Computer Science, Jiacun Wang, CRC Press, 2019.
2. Handbook of Model Checking, Edmund M. Clarke Jr., Thomas A. Henzinger, Helmut, Springer Press, 2018.

Course Code: CSC451 **Pre-Requisites:** CSC211

Course Title: Introduction to Modeling and Simulation

Credit Hours: 3(2, 1)

Course Objectives:

- To explain the basic principles of Modeling and Simulation (M&S) methodologies considering both theoretical and practical aspects;
- To introduce simulation methods and tools for discrete event systems;
- To apply verification and validation on simple simulation problems.

Course Contents:

This is an introductory course of modeling & simulation. Topics include: Introduction to Simulation; General Principles; Simulation Software; Statistical Models; Queuing Models; Random Number Generation; Random Variate Generation; Input Modeling; Verification and Validation; Output Analysis; Comparison & Evaluation; and Applications.

Recommended Books:

1. Introduction to Discrete Event Systems, Christos G. Cassandras, Stéphane Lafortune, Springer, 2021.
2. Applied Simulation Modeling, Seila, A.F., Ceric, V. &Tadikamalla, P., Thomson Learning Inc, 2013.
3. Discrete-Event Simulation: Modeling, Programming and Analysis, Fishman, G. S.,Springer-Verlag, 2010.
4. Discrete-Event System Simulation, Banks J., Carson II, J. S., Nelson, B. L. and Nicol, D. N., Prentice Hall, 2009.

Course Code: CSE357 **Pre-Requisite:** None

Course Title: Business Process Engineering

Credit Hours: 3(3, 0)

Course Objectives:

- To develop an ability to understand the characteristics of organizational business processes.
- To develop an ability to analyse the organizational business processes to identify the weaknesses in the existing processes.
- To develop an ability to propose improvements in organizational business processes.
- To employ modelling and flowcharting tools and notation for representation of organizational business processes.
- To develop an ability to apply process benchmarking concepts
- To develop an ability to describe the business process outsourcing concepts.

Course Contents:

This course aims to provide students with knowledge and experience relevant to organizational transformation. Topics include: Introduction to BPR; Enablers to BPR; Strategic Perspectives of BPR; Applications of Business Processes Reengineering; Tactics of BPR in IT, Software Reengineering & ERP; Models of Reengineering; Success Factors; Process Mapping and Change Management; and Case studies.

Recommended Books:

1. Business Process Reengineering, R Srinivasan, McGraw Hill, 2019.
2. Business process reengineering: an ICT approach, Chen, Chin Kang, Apple Academic Press, CRC, 2019.

Course Code: CSC456 **Pre-Requisite:** None

Course Title: Stochastic Processes

Credit Hours: 3(3, 0)

Course Objectives:

- To define basic concepts from the theory of Markov chains and present proofs for the most important theorems.
- To compute probabilities of transition between states and return to the initial state after long time intervals in Markov chains.
- To derive differential equations for time continuous Markov processes with a discrete state space.
- To solve differential equations for distributions and expectations in time continuous processes and determine corresponding limit distributions.

Course Contents:

The course covers stochastic processes and their applications. Topics include: Overview; Poisson Processes; Renewal Processes; Discrete-Time Markov Chain; Continuous-Time Markov Chains; Markov Renewal & Semi-Regenerative Processes; Brownian Motion and Diffusion Processes.

Recommended Books:

1. An Introduction to Stochastic Processes, Kao, E. P.C., Dover Publications, 2019.
2. Introduction to Stochastic Processes with R, Dobrow, R. P., Wiley, 2016.

Course Code: CSC412 **Pre-Requisite:** CSC241

Course Title: Visual Programming

Credit Hours: 3(2, 1)

Course Objectives:

- To explain the visual concepts of event-driven programming;
- To focus on graphical user interfaces in windows environment, program structure, language syntax, and implementation details for the development of visual programming based applications;
- To concentrate on the recent usage of platforms used in the development;
- To enable students through hands-on practice to develop small-scale applications.

Course Contents:

This course introduces the fundamental concepts related to the design and implementation of application based on visual programing. Topics Include: Visual Programming Basics; Fundamentals of Event-driven Programming; Windows Applications; Introduction to WPF & XAML; Markup Extensions; Deploying & Installing Windows Application; Working with Data; Database Connectivity; Threads; Introduction to ASP.NET Core; Entity Framework; Multiple Views & Controllers; and Code First & DB First Approach.

Recommended Books:

1. ASP.NET Core in Action, Second Edition, Andrew Lock, Mar 2021.
2. Modern Cross-Platform Development: Build intelligent apps, websites, and services with Blazor, ASP.NET Core, and Entity Framework Core using Visual Studio Code, Packt, 2020.
3. Microsoft Visual C# Step by Step (Step by Step Developer), Sharp, J., Microsoft Press, 2018.
4. Microsoft Docs, https://docs.microsoft.com.

Course Code: CSC495 **Pre-Requisite:** CSC241

Course Title: Game Development

Credit Hours: 4(3, 1)

Course Objectives:

- To discuss the leading trends in game development;
- To describe the concepts related to game play, game flow, interactive narratives, storytelling and apply them in practice to develop an addictive game;
- To practice main tools (game editors) available to develop games and to identify the best one for a specific purpose.

Course Contents:

This course will cover the following topics: Game Development Overview; Game Characters; Gameplay; HUD; Difficulty Balance; Game Development Engine Overview (Unity); Scenes and Game Objects; Graphics & Sound Material and Effects with URP & Shader Graph; Lighting Using the Universal Render Pipeline; Full Screen Effects with Post Processing; Sound & Music Integration; User Interface Design; Creating a UI using Toolkit; Creating Animation with Animator; Cinemachine & Timeline; C# & Visual Scripting; Movement & Spawning; Win & Lose Condition; AI for Game Development; and Releasing the Game.

Recommended Books:

1. Hands-On Unity 2021 Game Development: Create, customize, and optimize your own professional games from scratch with Unity 2021, Borromeo, N. A., Packt Publishing, 2021.
2. Agile Game Development with Scrum, Keith, C., Addison-Wesley, 2020.
3. The Art of Game Design: A Book of Lenses, Schell, J., Morgan Kaufmann, 2019.
4. Fundamentals of Game Design, Adams, E., New Riders, 2013.

Course Code: CSC337 **Pre-Requisite:** CSC336

Course Title: Advanced Web Technologies

Credit Hours: 3(2, 1)

Course Objectives:

- To build a Web Server in Node and understand how it really works,
- To design and develop REST API using Express and Node,
- To implement security on REST API,
- To implement Front End Application using React and Angular,
- To understand how the MERN and MEAN stack works,
- To build a web application and API using Express.JS framework.

Course Contents:

This course is aimed to give students the opportunity to learn current web technologies and programming techniques. Topics include: Technological Race; Concepts of JSON; MEAN Stack; MongoDB; Node.JS; Client Connector & Mongoose; Express JS Framework; REST API; Angular; MEAN Stack Application Development; React JS; and MERN Stack Application Development.

Recommended Books:

1. Beginning Node.js, Express & MongoDB Development, Lim, G., Amazon, 2019.
2. REST API Development with Node.js: Manage and Understand the Full Capabilities of Successful REST Development, Doglio, F., APress, 2018.
3. Pro Angular 9: Build Powerful and Dynamic Web Apps, Freeman, A., APress, 2020.
4. React and Libraries: Your Complete Guide to the React Ecosystem, Elrom, E., APress, 2021
5. Node.js Notes for Professionals, Free Internet Source, 2020.
6. Web Development with Node and Express, Ethan Brown,O'Reilly Publishing, 2019.
7. Building Modern Web Applications Using Angular, Kasagoni, S. K., Packt Inc, 2017.
8. Full-Stack React, TypeScript, and Node: Build cloud-ready web applications using React 17 with Hooks and GraphQL, Choi, D., Amazon Kindle Edition, 2020.

Course Code: CSC417 **Pre-Requisite:** None

Course Title: E-Commerce and Digital Marketing

Credit Hours: 3(2, 1)

Course Objectives:

- To create Ecommerce store on different digital platforms;
- To create web blogs and generate traffic;
- To implement different Search Engine optimization techniques;
- To generate business from different channels using SEO and Digital marketing;
- To identify the importance of the digital marketing for marketing success, to manage customer relationships across all digital channels and build better customer relationships,
- To be able to create a digital marketing plan and can execute it

Course Contents:

This course introduces E-Commerce and the modern digital marketing techniques. Topics Include: Overview of E-Commerce; Development of E-Commerce; E-Commerce Implementation Costs; Digital Marketing; Digital Marketing Technologies; AdWords Campaigns and Website Analytics; Google Analytics; Security threats in E-Commerce Environment; Legal issues in E-commerce; Online Auctions: E-Bay Case Study; Customer Relationship Management (CRM); Application of E-Commerce: Amazon Case study.

Recommended Books:

1. E-Commerce: Business, Technology, Society, by Kenneth C. Loudon, Pearson Edition, 2021.
2. Learn SEO with smart internet marketing strategies, Adam Clarke, 2021.
3. Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation, Ryan, D, Kogan Page Limited, 2020.
4. The Beginner's Guide to Digital Marketing Pulizzi,J, Mcgraw Hill Education, 2015.

Course Code: CSC418 **Pre-Requisite:** None

Course Title: DevOps for Cloud Computing

Credit Hours: 3(2, 1)

Course Objectives:

- Describe fundamental concepts of Cloud computing
- To develop an ability to deploy cloud key components on cloud service model.
- Able to use different cloud Microservices and serverless computing.
- To develop an ability to understand and deploy DevOps pipeline
- To develop an ability to deploy DevOps pipeline in cloud infrastructure.

Course Contents:

This course introduces the core concepts of implementing DevOps using cloud computing. Topics include: Cloud Computing; Service Models; Multi-Cloud; Deployment Models; Emerging Cloud Trends and Practices; Virtualization & Containerization; Components of a Cloud Infrastructure; Introduction to DevOps and its Roles; Source Control Management; DevOps Utility and Automation; CI/CD; Infrastructure as Code (IAC); SDLC of DevOps; Microservices; Serverless Computing; DevOps Cloud Native; Application Modernization; Deployment to Cloud; Operate and Monitor using DevOps Tools.

Recommended Books:

1. Cloud Computing with Security: Concepts and Practices, Naresh Kumar Sehgal, Pramod Chandra P. Bhatt, John M. Acken, Springer, 2020.
2. Practical DevOps: Implement DevOps in your organization by effectively building, deploying, testing, and monitoring code, Verona, J, Packt Publishing Ltd, 2018.
3. Cloud computing: implementation, management, and security, Ransome, J. F, CRC press, 2017.
4. Design and Implementation of Service Management in DevOps Enabled Cloud Computing Models. In Handbook of Research on End-to-End Cloud Computing Architecture Design, Eigenbrode, S., & Nassar, S, IGI Global, 2017.
5. Hands-On Serverless Computing, Kuldeep Chowhan, Packt Publishing, 2019.

Course Code: CSC334 **Pre-Requisite:** CSC323

Course Title: Parallel and Distributed Computing

Credit Hours: 3(2, 1)

Course Objectives:

- To explain the fundamental concepts of parallel and distributed computing along with its benefits and limitations;
- To provide an understanding of basic concepts of parallel and distributed systems paradigms: Grid Computing, Cloud Computing, cluster and Peer-to-Peer Computing;
- To develop an understanding of the application of parallel and distributed algorithms in problem solving;
- To provide hands-on experience of distributed and parallel programming paradigms using open MPI.

Course Contents:

This course covers the basic concepts and applications of parallel & distributed computing. Topics include: Distributed Systems; Parallel Computing; Virtual Machines & Virtualization; Parallel Algorithms & Patterns; OpenMP; GPU Concepts & Architectures; and GPU Programming Model.

Recommended Books:

1. Parallel and High Performance Computing, Robey, R., Zamora, Y., Manning, 2021.
2. Distributed and Cloud Computing: From Parallel Processing to the Internet of Things, Hwang, K., Fox, C. G., Dongarra, J. J., Morgan Kaufmann, 2011.
3. Distributed Systems: Concepts and Design, Coulouris, G., Dollimore, J. & Kindberg, Addison-Wesley, Pearson, 2011.

Course Code: CSC402 **Pre-Requisite:** CSC270

Course Title: Database Systems II

Credit Hours: 3(3, 0)

Course Objectives:

- Describe fundamental theories and requirements that influence the design of modern database systems;
- To explain the background processes involved in query processing & optimization, concurrent transactions, recovery and security of databases;
- To present the architecture and implementation of distributed and replicated database systems;
- To discuss the concepts related to emerging database technologies.

Course Contents:

This course provides knowledge and covers more sophisticated aspects of advanced databases. Topics include: Transaction Processing & Management; Concurrency Control Techniques; Database Backup & Recovery; Query Processing & Optimization; Object-Oriented DBMS; Emerging Database Technologies.

Recommended Books:

1. Database Systems A Practical Approach to Design, Implementation, and Management, Thomas M. Connolly, Pearson, 2015.
2. Fundamentals of Database Systems, Elmasri, & Navathe, Pearson, 2015.

Course Code: CSC471 **Pre-Requisite:** CSC270

Course Title: Distributed Database Systems

Credit Hours: 3(3, 0)

Course Objectives:

- Understanding the need of Distributed Databases (DDBS);
- Understanding fragmentation and its different types along with replication in DDBS;
- Understanding query processing and optimization along with administration issues in DDBS, failure recovery, transaction management and concurrency control;
- Development of concepts in parallel databases, distributed object databases, and multi-databases.

Course Contents:

This course provides introduction to Distributed Database Systems (DDBSs). Topics include: Distributed Database Systems; Database & Networking Concepts; Distributed Database Design; Semantic Data Control; Distributed Query Processing; Query Decomposition & Data Localization; Optimization of Distributed Queries; Transaction Management & Distributed Concurrency Control; Distributed DBMS Reliability; Parallel Database Systems; Current Issues in DDBSs; and Use of the MapReduce Processing Model.

Recommended Books:

1. Principles of Distributed Database Systems, Özsu, M.T., & Valduriez, P, Springer, 2020.
2. Fundamentals of Database Systems, Elmasri, & Navathe, Pearson, 2015.

Course Code: CSC461 **Pre-Requisite:** MTH262

Course Title: Introduction to Data Science

Credit Hours: 3(3, 0)

Course Objectives:

- Identify and classify data science problems;
- Understanding of the skills required for data analytics at massive levels – scalable data management on and off the cloud;
- Understanding of the basic techniques of data science, including both SQL and NoSQL solutions for massive data management (e.g., Hadoop, MapReduce and contemporaries);
- Understanding of the algorithms for data mining (e.g., clustering and association rule mining), and basic statistical modeling (e.g., linear and non-linear regression) in the context of big data.

Course Contents:

This course provides the basic concepts and principles of Data Science. The topics include: Overview of Data Science; Landscape; Tools & Applications; Introduction to R & RStudio; Data Visualization Techniques; Data Wrangling; Statistical Modeling; Predictive Modeling; and Data Science Ethics.

Recommended Books:

1. Modern Data Science with R, Benjamin S. Baumer, Daniel T. Kaplan, Nicholas J. Horton, Chapman and Hall, 2021.
2. Introduction to Data Science Data Analysis and Prediction Algorithms with R, Rafael A. Irizarry, CRC Press, 2021.

Course Code: CSC331 **Pre-Requisite:** MTH262

Course Title: Digital Image Processing

Credit Hours: 3(3, 0)

Course Objectives:

- To explain the image formation process;
- To discuss the basic image acquisition process, and its representation;
- To explain the basic image processing techniques in both spatial and frequency domains;
- To present the usage of these techniques on small (workable) image segments;
- To explain various segmentation approaches, along with their characteristics, differences, strengths, and weaknesses;
- To explain the need for different image morphological algorithms and transformations.

Course Contents:

This course gives an overview of the fundamental theories and techniques of digital image processing. The topics include: Digitized Image & its Properties; Image Enhancement & Restoration; Image Segmentation; Shape Representation & Description; Morphological Image Processing; Linear Discrete Image Transforms; and Image Data Compression.

Recommended Books:

1. Digital Image Processing A Complete Guide, Gerardus Blokdyk, 5STARCooks, 2020.
2. Digital Image Processing, Gonzalez, R.C. & Woods, R.E., Pearson, 2018.

Course Code: CSC454 **Pre-Requisite:** None

Course Title: Pattern Recognition

Credit Hours: 3(3, 0)

Course Objectives:

- To introduce the fundamentals of pattern recognition;
- To present the generative methods such as Bayes decision theory, parameter and density estimation;
- To explain the discriminative methods such as support vector machines and nearest neighbor classification;
- To discuss pattern recognition applications;
- To focus on explaining the computer vision as a major application of pattern recognition.

Course Contents:

The topics include Overview of Pattern Recognition; Density Estimation; Linear & Nonlinear Discriminant Analysis; Feature Selection & Extraction, and Applications.

Recommended Books:

1. Essentials of Pattern Recognition, An Accessible Approach, Jianxin Wu, Cambridge University Press, 2020.
2. Fundamentals of Pattern Recognition and Machine Learning, Ulisses Braga-Neto, Springer International Publishing, 2020.

Course Code: CSC462 **Pre-Requisite:** CSC102

Course Title: Artificial Intelligence

Credit Hours: 4(3, 1)

Course Objectives:

- Describe the fundamentals of Artificial Intelligence;
- Implement an appropriate uninformed/informed search algorithm for a problem and characterize its time and space complexity;
- Translate natural language sentences (e.g. English) into logic statements;
- Convert logic statements into a clause form and apply resolution to a set of logic statements to answer a query;
- Explain the basic machine learning tasks and techniques.

Course Contents:

This course gives a broad overview of the fundamental theories and techniques of Artificial Intelligence. Topics include: Overview of Artificial Intelligence; Agents & Environments; Problem-Solving; Adversarial Search; Constraint Satisfaction Problems; Knowledge Representation & Reasoning; Uncertainty; and Automated Planning.

Recommended Books:

1. Artificial Intelligence: A Modern Approach, Russell, S., and Norvig, P., Pearson, 2020.
2. Artificial Intelligence Basics: A Non-Technical Introduction, Taulli, T., Apress, 2019.

Course Code: CSC455 **Pre-Requisite:** None

Course Title: Computer Vision

Credit Hours: 3(3, 0)

Course Objectives:

- To provide an introduction to basic concepts and methodologies for recognition and extraction of features from raster images;
- To provide a foundation for developing applications and for further study in the field;
- To gain practical experience in the design and implementation of image processing algorithms.

Course Contents:

The topics covers includes: Overview of Computer Vision; Multiple Views & Motion; Feature Detection & Matching; Recognition; Geometry for 3D Vision; Motion Analysis; and Deep Networks.

Recommended Books:

1. Computer Vision: Algorithms and Applications, Richard Szeliski, Springer, 2021.
2. Computer Vision Using Deep Learning: Neural Network Architectures with Python and Keras, Verdhan, Vaibhav, Apress, 2021.

Course Code: CSE354 **Pre-Requisite:** None

Course Title: Design Patterns

Credit Hours: 3(2, 1)

Course Objectives:

- To provide a specific context for each pattern in which it can be applied;
- To explain how the different components of the pattern collaborate with each other;
- To list the consequences of applying each pattern to the overall software quality of a system;
- To list which patterns are interrelated to a rule and its character.

Course Contents:

This course focuses on the fundamental concepts and principles used in design patterns. Topics include: Design Patterns; Cataloging Design Patterns; Agile Coding with Design Patterns Code; GRASP; SOLID Principles; Adaptive Design Patterns; Creational Design Patterns; Structural Design Patterns; and Behavioral Design Patterns.

Recommended Books:

1. Design Patterns: Elements of Reusable Object-oriented Software, Erich Gamma, Richard Helm, Ralph E. Johnson & John Vlissides, Pearson Education, 2015.
2. Adaptive Code: Agile Coding with Design Patterns and SOLID Principles, Gar McLean Hall, Microsoft Press, 2017.
3. Design Patterns, Christopher G. Lasater, Wordware Publishing, Inc., 2007.
4. Object-Oriented Design and Patterns, Horstmann C., John Wiley & Sons, 2006.
5. Design Patterns in Java, Metsker S. J. & Wake W. C., Addison-Wesley, 2006.

Course Code: CSE300 **Pre-Requisite:** CSC291

Course Title: Software Metrics

Credit Hours: 3(3, 0)

Course Objectives:

- To identify and explain the main elements of a viewpoint-based framework for software measurement;
- To understand the metrology concepts from science and engineering, using them as criteria to: analyze strengths and weaknesses of some of the software metrics most often quoted for software systems;
- To understand the Software product and process measurements;
- To design new software metrics for software systems.

Course Contents:

This course covers foundations and models of software measurement theory. Topics include: Software Measurement; Goal Based Frameworks; Empirical Investigation; Data Collection & Analysis; Metrics for Decision Support; Software Engineering Measurement; Measuring External Product Attributes; and Software Reliability.

Recommended Books:

1. Software Metrics, A Rigorous and Practical Approach, Norman Fentom, James Bieman, CRC Press, 2020.
2. Software Measurement and Estimation: A Practical Approach, (Quantitative Software Engineering Series), Laird, L. and Brennan, C., Wiley-IEEE Computer Society, 2014.

Course Code: CSE331 **Pre-Requisite:** None

Course Title: Software Engineering Economics

Credit Hours: 3(3, 0)

Course Objectives:

- To understand the applications of economics on software engineering projects;
- To emphasis on relevant micro-economic concepts, perform trade-off, and business-case economic analysis of software products.

Course Contents:

This course covers best practices used in software engineering economics. Topics include: Software Engineering Economics Fundamentals; Life Cycle Economics; Risk & Uncertainty; Economic Analysis Methods; and Practical Considerations.

Recommended Books:

1. Software Project Effort Estimation: Foundations and Best Practice Guidelines for Success, Adam Trendowicz & Ross Jeffery, Springer, 2014.
2. The Economics of Iterative Software Development: Steering Toward Better Business Results, Walker Royce, Kurt Bittner & Michael Perrow, Addison-Wesley Professional, 2009.

Course Code: CSE332 **Pre-Requisite:** None

Course Title: Information System Audit

Credit Hours: 3(3, 0)

Course Objectives:

- To understand the role of the Information System (IS) auditor and the IS audit function;
- To understand the purpose of controls in an IS environment;
- To learn how access to systems, resources, and data can be controlled;
- To assess the design, placement, and quality controls.

Course Contents:

This course introduces the best practices and methods to audit information systems. Topics include: Information Systems; Assessing the Financial Stability; Examining Organization Contracts; Physical Security; Logical Security; Control Self-Assessment; Computer Forensics; Contemporary Auditing; Project Management Audits; Humanistic Aspects.

Recommended Books:

1. Information Technology Control and Audit, Angel R. Otero, Auerbach, 2018.
2. Auditing Information Systems, Jack J. Champlain, Wiley, 2003.

Course Code: CSE333 **Pre-Requisite:** None

Course Title: Software Process Improvement

Credit Hours: 3(3, 0)

Course Objectives:

- To develop specialized versions of process models;
- To customize existing models that can meet requirements of organizations;
- To perform quality analysis of software process.

Course Contents:

This course covers the following topics: Introduction to Software Processes Improvement; Prescriptive Process Models; Descriptive Process Models; Software Process Improvement Modeling; Continuous Improvement Approaches; CMM & CMMI; Software Process Improvement Tool; and Software Process Simulation.

Recommended Books:

1. Software Process Definition and Management , J. Münch, O. Armbrust, M. Kowalczyk, M. Soto, Springer, 2012.
2. Introduction to Software Process Improvement, Regan, G., Springer, 2011.
3. Software Process Improvement and Management: Approaches and Tools for Practical Development, Shukor, S. Fauzi, H. N., Nuraminah R., Sahibuddin, S., IGI Global, 2011.
4. Introduction to Agile Methods, Ashmore, Sondra, and Kristin Runyan, Addison-Wesley Professional, 2014.

Course Code: CSE334 **Pre-Requisite:** None

Course Title: Reverse Engineering of Source Code

Credit Hours: 3(2, 1)

Course Objectives:

- To understand the real-life practices of reverse engineering techniques in industries;
- To recover the design and architectural artifacts from the source code.

Course Contents:

The course will cover the following topics: Reverse Engineering Overview; Low-Level Languages Reversing; Static and Dynamic Reversing; Tools; RE in Linux & Windows Platforms; Sandboxing; Binary Obfuscation Techniques; and Packing and Encryption.

Recommended Books:

1. Mastering Reverse Engineering: Re-engineer your ethical hacking skills, Wong, R., Packt Publishing, 2018.
2. Practical Reverse Engineering: x86, x64, ARM, Windows Kernel, Reversing Tools, and Obfuscation, Dang, B. et al., Wiley, 2014.

Course Code: CSC325 **Pre-Requisite:** EEE241

Course Title: Computer Organization & Assembly Language

Credit Hours: 4(3, 1)

Course Objectives:

- To explain the basic characteristics of a microprocessor and its applications;
- To present the basic architecture of the IA-32 processor;
- To provide a comprehensive understanding of 80X86 instruction set;
- To develop an understanding of the basic steps of assembling, linking and executing an assembly program;
- To solve a given problem by writing programs in assembly language.

Course Contents:

This course covers the concepts of computer organization along with programming in Assembly language. Topics include: Preliminary Concepts of Computer Organization; Von Neumann Architecture; IA-32 Microprocessors Organization; Modes of the processors; Non-Von Neumann Architectures; Pipelined vs. Non-Pipelined Systems; Parallel Processing; CISC vs. RISC Processors; Instructions Set Design & Formats; Addressing Modes; Memory System Organization & Architecture; Utilization of Memory Systems in Programming; IO Fundamentals; Data Transfer methods; CPU Performance Calculation; and Assembly Language Programming.

Recommended Books:

1. Assembly Language for x86 Processors, Irvine, K.R., Pearson, 2020.
2. Computer Organization and Architecture, William S., Pearson, 2019.
3. Essentials of Computer Organization and Architecture, Null L., Jones and Bartlett, 2019.

Course Code: CSE360 **Pre-Requisite:** None

Course Title: Software Safety Critical Systems

Credit Hours: 3(3, 0)

Course Objectives:

- To introduce specific issues and problems associated with safety critical applications;
- To discuss range of safety analysis techniques including HAZOP, Failure Modes, Effects and Criticality Analysis (FMECA), Fault Tree Analysis;
- To present architectural design of safety critical systems and the factors that lead to specific architectural decisions;
- To demonstrate a variety of specific techniques for developing safety critical systems, including formal testing, high-integrity programming (including the use of SPARK), software inspection and threads analysis;
- To describe various human cognitive and social considerations that lead to errors and failures in systems development;
- To provide organizational aspects of safety critical systems projects.

Course Contents:

This course introduces issues associated with safety critical applications. Topics include: Overview of Safety Critical Systems; Safety Critical System Architecture; Fault Tolerance; Coding Standards & Programming Language; Verification; and Case Studies.

Recommended Books:

1. Embedded Software Development for Safety-Critical Systems, Hobbs C, CRC Press, 2019.
2. Developing Safety-Critical Software: A Practical Guide for Aviation Software and DO-178C Compliance, Rierson L, CRC Press, 2013.

Course Code: CSE361 **Pre-Requisite:** None

Course Title: Software Fault Tolerance

Credit Hours: 3(3, 0)

Course Objectives:

- To understand the fundamental concepts of fault-tolerance;
- To demonstrate the techniques for achieving fault-tolerance in software systems;
- To develop skills in modeling and evaluating fault-tolerant architectures in terms of reliability, availability and safety;
- To gain knowledge in sources of faults and means for their prevention and forecasting;
- To describe merits and limitations of fault-tolerant design.

Course Contents:

Topics covers in this course are: Overview of Software Fault Tolerance; Structuring Redundancy for Software Fault Tolerance; Design Methods; Programming Techniques & Issues; Design Diverse Software Fault Tolerance Techniques; Dependability & Redundancy; and Case Studies.

Recommended Books:

1. Fault-Tolerant Design, Dubrova, E., Springer, 2013.
2. Software Fault Tolerance Techniques and Implementation, Pullum, L. L., Artech House, 2001.

Course Code: CSC354 **Pre-Requisite:** None

Course Title: Machine Learning

Credit Hours: 3(3, 0)

Course Objectives:

- To present the basic machine learning concepts;
- To present a range of machine learning algorithms along with their strengths and weaknesses;
- To apply machine learning algorithms to solve problems of moderate complexity.

Course Contents:

This course provides the overview of machine learning along with various learning tasks. Topics include: Overview of Machine Learning; Supervised Learning; Unsupervised Learning; Reinforcement Learning; and Deep Learning.

Recommended Books:

1. Introduction to Machine Learning, Ethem Alpaydin, MIT Press, 2010.
2. Machine Learning, Tom, M., McGraw Hill, 1997.
3. Hands on Machine Learning with Scikit-Learn and TensorFlow, Aurelien Geron, O`Reilly Media, 2017.
4. Deep Learning with PyTorch – Essential Excerpts, Eli Stevens, Luca Antiga, Thomas Viehmann, Manning Publications, 2009.
5. Pattern Recognition and Machine Learning, Bishop, C., Springer-Verlag, 2007.

Course Code: CSC497 **Pre-Requisite:** CSC270

Course Title: Data Warehousing and Data Mining

Credit Hours: 3(2, 1)

Course Objectives:

- To explain the concept of collecting and integrating data arising from different sources to build a data warehouse;
- To present the knowledge of architectures and implementations of a data warehouse, as well as the guidelines to be followed in its maintenance;
- To introduce the dimensional modeling techniques for the design of the data warehouse;
- Application of data warehouse design in a warehouse building tool and performing analysis using OLAP tool;
- To explain the aspects of different data mining tasks: classification, association rules and clustering;
- To analyze data mining tasks using UCL datasets in a data mining tool such as WEKA.

Course Contents:

This course covers the concepts of data warehousing and data mining along with their applications. Topics include: Data Warehousing Fundamentals; Data Warehousing & ERP; Data Warehousing Life Cycle; Data Warehousing Architecture; Dimension Modeling; Data Quality Management; Online Analytical Processing (OLAP) Systems; Extract Transform Load (ETL) Process; Introduction to Data Mining Concepts; Data Preprocessing; Classification; Association Rule Mining; and Clustering.

Recommended Books:

1. Data Mining and Data Warehousing: Principles and Practical Techniques, Parteek Bhatia, Cambridge University Press, 2019.
2. The Data Warehouse Toolkit: The Definitive Guide to Dimensional, Ralph Kimball & Margy Ross, Wiley, 2013.
3. Data Mining - Concepts and Techniques, Jiawei Han & Micheline Kamber, China Machine Press, 2006.
4. The Data Warehouse ETL Toolkit: Practical Techniques for Extracting, Cleaning, Conforming, and Delivering Data, Ralph Kimball & Margy Ross, Wiley, 2004.
5. Introduction to Data Mining, Pang-Ning Tan, Michael Steinbach, Anuj Karpatne & Vipin Kumar, Pearson, 2018.

Course Code: CSC353 **Pre-Requisite:** MTH231

Course Title: Computer Graphics

Credit Hours: 3(2, 1)

Course Objectives:

- To introduce the fundamental concepts of computer graphics;
- To explain the graphics pipeline approach;
- To provide an understanding of visualization of 2D & 3D objects using geometric primitives;
- To provide an understanding of basic concepts of projection of 3D objects and camera calibration;
- To explain the fundamental aspects of geometric modeling (e.g. curves & surfaces);
- To develop an understanding of animation techniques related to computer graphics.

Course Contents:

This course covers the key concepts of computer graphics and their applications. Topics Include: Graphics Systems Overview; Pixels for Visual Display; Hardwar, Software & APIs; Interactive Input Methods; Animation; Graphics Pipeline & Modeling; Vector & Raster Graphics; Programming Raster Display Systems; 2-D & 3-D Transformations; Additive & Subtractive Color Models; Clipping & Viewing; Projections; Camera Concepts; Rendering; Lighting; Shading; Material Properties; Illumination Models; Texture & Bump Mapping; Splines & Curves; Scene Graphs; GPU; and Programmable Pipeline.

Recommended Books:

1. Fundamentals of Computer Graphics, Steve Marschner, Peter Shirley, CRC Press, 2021.
2. Interactive Computer Graphics, Edward Angel & Dave Shreiner, Pearson, 2020.

Course Code: CSC448 **Pre-Requisite:** None

Course Title: Data Visualization

Credit Hours: 3(3, 0)

Course Objectives:

- To understand the difference between different types of input data;
- To learn visualization techniques to solve scientific and physical problems related with CAD and CAGD.

Course Contents:

This course covers visualization theory and methodology. Topics include: Introduction to Data & Information Visualization; The Visualization Pipeline; Data Encoding & Transformation Techniques; Advance Data & Visual Simplification Techniques; Visualization Building Blocks & Encoding Methods; Interaction & Exploration Techniques; Data Visualization Programming using Visualization Libraries; Visualization of High Dimensional Data; Interaction Techniques.

Recommended Books:

1. Interactive Data Visualization for the Web, Scott Murray, O'Reilly Press, 2017.
2. Visualization Analysis and Design, T. Munzner, AK Peters, CRC Press, 2015.
3. Data Visualization - Principles and Practice, Alexandru C. Telea, CRC Press, 2014.

Course Code: CSE344 **Pre-Requisite:** None

Course Title: Semantic Web

Credit Hours: 3(2, 1)

Course Objectives:

- To provide the concepts of features, rationale, and advantages of Semantic Web technology.
- To sketch the overall architecture of the semantic web;
- Identify the component technologies & languages of the semantic web and their role.

Course Contents:

The aim of this course is to teach concepts, technologies and techniques used in Semantic Web. Topics include: Semantic Web Overview & Environment; Structured Web Documents; Basic Elements of RDF; Taxonomy & Ontology; Application Scenarios; Ontology Engineering; Semi-automatic Methods; On-To-Knowledge Semantic Web Architecture; Validating OWL Ontology; Related Development Tools; and API Based OWL Ontology.

Recommended Books:

1. Semantic web for the working ontologist, Allemang, D. and Handler, J., Morgan Kaufmann, 2020.
2. A semantic web Primer, Antoniou, G. and Harmelen, F. V., The MIT Press, 2015.

Course Code: CSC336 **Pre-Requisite:** CSC241

Course Title: Web Technologies

Credit Hours: 3(2, 1)

Course Objectives:

- To explain the fundamental concepts of web architectures and its applications;
- To provide an understanding of Search Engine Optimization (SEO);
- To provide an understanding of planning, designing and publishing a multi-page website;
- To provide hands-on experience of client-side technologies such as HTML, JavaScript, CSS;
- To provide practical experience of development of dynamic clients using modern development technologies, for example PHP, AJAX, MySQL.

Course Contents:

This course introduces the modern web technologies used for the web development. Topics include: Overview of Web Platforms; Web Architectures; Markup Languages; Styling; Client-Side Scripting Languages; Server-Side Technologies; Use of Databases in Web-based Applications; Web APIs; Programming under Platform Constraints; Security Issues; and Web Hosting.

Recommended Books:

1. Web Design Playground: HTML & CSS the Interactive Way, Paul McFedries, Manning, 2019.
2. Beginning PHP and MySQL: From Novice to Professional, Frank M. Kromann, Apress, 2018.
3. Laravel Up and Running, A Framework for Building Modern PHP Apps, Matt. Stauffer, Oreilly, 2019.
4. Web Engineering, Sahil Rai, Kuk University Notes, 2020.
5. Web Programming with HTML5, CSS, and JavaScript, John Dean, Jones & Bartlett Learning 2018.

Course Code: CSC303 **Pre-Requisite:** CSC241

Course Title: Mobile Application Development

Credit Hours: 3(2, 1)

Course Objectives:

- Discuss different mobile application development platforms and architectures;
- Discuss the components of mobile application development;
- Compare different mobile application development tools;
- Describe the constraints that game platforms impose on developers;
- Develop a medium sized mobile application as a team.

Course Contents:

This course introduces the fundamental concepts related to the design and implementation of mobile application that uses JavaScript and React Native. Topics Include: Overview; Concepts of JavaScript; Programming in React Native; GitHub; Concepts of React Navigation; Working with Multiple Screens with React Navigation; Working with Persistent Storage using AsyncStorage; Retrieving Data from Server using API; State Management and Redux; Accessing Device Camera; GPS & Google Maps API; Working with Mobile Sensor; and Ejecting & Publishing Mobile Applications.

Recommended Books:

1. React Native in Action, Nader Dabit, Manning Publications, 2019.
2. Fullstack React Native, Shoemaker, Sophia, Djirdeh, Houssein,, Published by Fullstack.io, 2019.