Course Title: Functional English
Course Code: ENG 105
Prerequisite: None
Credit Hours: 3
Contact Hours: 3

Course Content: Introduction to the course—writing skills, five types of writing styles: Persuasive, narrative, compare and contrast, expository and descriptive, Introduction to Parts of Speech ,Activities on types of writing in the classroom Introduction to reading skills , English Conversation & presentation Group Project [students create an advertisement of any product which they will sale, note that should not be from the existing products, Précis writing and how to write a précis, Rules of writing summary, Activates in classroom, Tenses: present, past and future tense, Essay writing: rules of writing an Essay Types, five paragraphs, long essays, thesis statement, Students should be able to write descriptive, argumentative and persuasive essays, Classroom activity on Essay writing, Teachers' feedback on student's individual Essay writing, Course book, How to build effective paragraph, Paragraphs: structure, types, topic and topic sentence, unity, adequate development and coherence and completeness in paragraphs.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Recall the basic rules of grammar, punctuation and style in written English	C1	PLO12
2	Understand vocabulary, grammar and writing in English an effective tool for communication	C2	PLO12
3	Present the use of English in professional life	A2	PLO10
4	Comprehend language varieties and improve the usage of four language skills (Reading, listening , Speaking, Writing)	C2	PLO12

Recommended Books:

Text Book(s):
- Doff. A., Jones C.(2000).Language in Use (2nd Edition) .Cambridge

Reference Book(s):
- Thomson. A. and Martine. A.(1986).A Practical English Grammar (4th Edition) .oxford
- Murphy.R.(2012).English Grammar in Use (4th Edition) .Cambridge University Press

Course Title: Applied Physics
Course Code: GSC 114
Prerequisite: None
Credit Hours: 2
Contact Hours: 2

Course Content: Physics Introduction, Force and Motion, Newton's Law of Motion, Newton's Law of Universal Gravitation, Rigid Bodies, Deformable Bodies and Torque, Moment of Force, Equilibrium, Equilibrium Numerical, Equations of Motion and its Numerical, Centripetal and Centrifugal Force, Scalars and Vectors, Laws of Vector, Vector Diagrams and Numerical, Directions Cosines, Law of Sine and Cosine, Collinear Vectors and Coplanar Vectors, Non Collinear Vectors and Non Coplanar Vectors, Scalar Field, Vector Field and Linear Dependence, Vector Numerical, Electricity and Magnetism, Charging and charging by Induction, Atomic Structure of Elements, Role of Atomic Structure in Conduction of Electricity, Coulomb's Law and Electrostatic Force, Electric Field Intensity, Electric Potential due to Point Charge, Resistivity and Resistances, Conductivity and Electric Power

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	recall the fundamental laws of physics and vectors relevant to the engineering sciences	C1	PLO1
2	describe the phenomenon of electromagnetism, induction, mechanics, kinematics and atomic structures	C2	PLO1
3	Apply the laws of physics to solve problems pertaining to engineering scenarios.	C3	PLO2

Recommended Books:

Text Book(s):

- David Halliday, Jearl Walker and Robert Resnick.(2014).Principles of Physics (10th Edition) .

Reference Book(s):

- David Halliday, Robert ..Fundamentals of Physics (Extended), (10th Edition) .Wiley

Course Title: Applied Physics Lab
Course Code: GSL 113
Prerequisite: None
Credit Hours: 1
Contact Hours: 3

Course Content: This Lab will cover following content Physics Introduction, Force and Motion, Newton's Law of Motion, Newton's Law of Universal Gravitation, Rigid Bodies, Deformable Bodies and Torque, Moment of Force etc.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Follow the instructions to perform task related to physical quantities (mass, length, time period and frequency) and behavior of various electrical components under electrical & electromagnetic fields.	P3	PLO5
2	Display the spirit of self-reliance to complete the lab journal timely and professionally.	A5	PLO9
3	Show the ability to perform operations pertaining to hardware application by using galvanometer, meter bridge, Melde's apparatus, photovoltaic cell etc.	P2	PLO5
4	Design & implement Applied Physics based solution for solving a real-life complex problem.	P4	PLO3
5	Display project management skills and objective based approach to develop Applied Physics solutions in a teamwork environment.	A5	PLO11

Course Title: Discrete Structures
Course Code: CSC 115
Prerequisite: None
Credit Hours: 3
Contact Hours: 3

Course Content The course would cover introduction to Discrete Structures, Propositional Calculus, Biconditionals, Equivalence, Applications to Natural Language and System Specification, Predicates and Quantifiers, Algorithms: Searching, Linear and Binary Search, Sorting: Bubble Sort, Insertion Sort, Algorithmic Efficiency: Big O Notation; Theorems and Examples, Big O for Combinations of Functions, Complexity of Algorithms: Linear and, Binary Search, Miscellaneous Asymptotic Analysis Topics, Counting: Product and Sum Rules, Pigeonhole Principle: Generalized Pigeonhole Principle. Permutations and Combinations: Binomial Theorem and Identities, Pascal's Identity, Pascal's Triangle, Number Theory: Divisibility, Division Algorithm, Modular Arithmetic, Modular Arithmetic and Congruence, Prime Numbers, Fundamental Theorem of Arithmetic, GCD, LCM. Review of Number Theory, Algorithm for div and mod (Quotient and Remainder), Euclid's Algorithm for GCD, Review of Asymptotic Analysis, Integer representations, Computing representations, Integer addition algorithm, Integer multiplication algorithm, Exponentiation, Exponentiation Algorithms, Graph Theory Introduction, Types of Graphs. Paths and Circuits: Euler Circuits and Paths, Graph Isomorphism. Planar Graphs, K3, 3, Euler's Formula. Shortest Path Problems and Dijkstra's Algorithm, Complexity, Hamiltonian Circuits, Traveling Salesman Problem. Trees: Definitions and basic properties, Applications of Trees: Searching, Binary Search Trees, Tree Traversal: Inorder, Preorder, Postorder, Applications to file systems, expressions. Spanning Trees: Construction of spanning trees, Breadth First Search, Depth First Search, Minimum Spanning Trees.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Define the concepts and theorems of discrete structures.	C1	PLO1
2	Proof the mathematical theorems and explain and ideas.	C2	PLO2
3	Apply the concepts and techniques suitable for the solution of a given problem.	C3	PLO2

Recommended Books:

Text Book(s):

Kenneth H Rosen.(2011).Discrete Mathematics and its Applications (7th Edition) .McGraw-Hill Education

Reference Book(s):

C L Liu.(1986).Elements of Discrete Mathematics (2nd Edition) .McGraw-Hill Education

Course Title: Object Oriented Programming
Course Code: CSC 210
Prerequisite: CSC 113
Credit Hours: 3
Contact Hours: 3

Course Content: The course is designed to familiarize students with objects and classes. Design and implementation focuses on object oriented programming paradigm. Real World Problems are solved using alternatives provided in OOP, differentiating between procedural and OOP Programming, properties of object oriented programming, Data Abstraction, Encapsulation, Method overloading, Inheritance, Method overriding, Constructors, Generalization and Specialization, Association, Aggregation and Composition, Polymorphism, Static members, Abstract classes, Interfaces.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	**Describe** the fundamental concepts of Object Oriented Programming for example Constructors, Destructors, Encapsulation, this pointer, Inheritance, Aggregation, Composition etc.	C1	PLO1
2	**Explain** and compare some of the advanced OOP concepts like subtyping, specialization, Multilevel and Hierarchical inheritance, native, final modifiers, static and dynamic binding etc.	C2	PLO1
3	**Apply** OOP programming concepts for problem solving.	C3	PLO3
4	Present an advanced programming topic confidently and professionally.	A2	PLO9

Recommended Books:

Text Book(s):

- Silberschatz, Henry F . Korth, S. Sudarshan..The Fundamental Concepts of Object-Oriented Programming (6th Edition) .McGraw-Hill

Reference Book(s):

- Andrew Troelsen and Philip Japikse.C# 6.0 and the .NET 4.6 Framework (7th Edition).Apress
- Simon Kendal .Object-Oriented Programming using C#. (2nd Edition). Bookbon
- Clark and Dan..Beginning C# Object-Oriented Programming (1st Edition).Apress

Course Title: Object Oriented Programming Lab
Course Code: CSL-210
Prerequisite: None
Credit Hours: 1
Contact Hours: 3

Course Content: This Lab will cover implementation of Data Abstraction, Encapsulation, Method overloading, Inheritance, Method overriding, Constructors, Generalization and Specialization, Association, Aggregation and Composition, Polymorphism, Static members, Abstract classes, Interfaces.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Follow the instructions to design applications using Java and jFrame and perform tasks related to Object Oriented Programming.	P3	PLO5
2	Display the spirit of self-reliance to complete the lab journal timely and professionally.	A5	PLO9
3	Show the capability of acting and performing a sequence of steps to implement object oriented solutions in response to a given scenario.	P2	PLO5
4	Design & implement solutions for object-oriented programming related problems.	P4	PLO3
5	Display project management skills and objective based approach to develop networking solutions in a teamwork environment.	A5	PLO11

Course Title: Introduction to Software Engineering
Course Code: SEN 210
Prerequisite: None
Credit Hours: 3
Contact Hours: 3

Course Content: Software engineering is the branch of computer science that creates practical, cost-effective solutions to computing and information processing problems, preferentially by applying scientific knowledge, developing software systems. This course covers the fundamentals of software engineering, an understanding of different software processes and how to choose between them, study of Requirements Engineering and an overview of various modeling techniques applicable to requirements and specifications including UML and formal modeling.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Define various software Engineering concepts and practices.	C1	PLO1
2	Explain basic concepts of Software Engineering approaches & techniques.	C2	PLO1
3	Apply software engineering techniques suitable for a given scenario	C3	PLO2
4	Analyze situations for the implementation of software engineering processes/methodologies.	C4	PLO2

Recommended Books:

Text Book(s):

- Roger S. Pressman.(2005).Software Engineering (A practitioners approach) (6th edition) .McGraw-Hill Education

Reference Book(s):

- Orlando Karam Barbara Bernal.(2018).Software Engineering (4th edition) .Jones & Bartlett Learning
- Verderber, F. Verderber.(2014).S. Communicate! (4th edition) .Oxford University Press

Course Title: Communication Skills
Course Code: HSS 120
Prerequisite: ENG 105
Credit Hours: 3
Contact Hours: 3

Course Content: Communication process & settings, Basic principles of communication, Major ethical issues communicators face, Purposes of language, Relationship between language and meaning, Culture and gender effects ,Making language clear & memorable, Demographic audience analysis, You-Attitude, Spoken versus Written Discourse, Characteristics of nonverbal communication, Ways to communicate nonverbally with bodies, voice, use of space appearance & time, Characteristics of nonverbal communication, Outlining the speech, Harness the power of humor, Methods of delivery , Tone, pitch, pace and pause, Overcoming Speech anxiety/ building confidence, Time management, Types of listening, Tactics help remember what we hear, Barriers to effective listening, Listening & responding, reporting telephone conversation, paraphrasing of brainy quotes, What is plagiarism?, No to plagiarism, Topic selection & determining the purpose, Tips for doing research, Importance of visual cues, Making & giving effective power point presentations, Pictorial presentation of statistical data, PROBLEM SOLVING, Importance of Leadership & teamwork, group discussions, a few case studies/ articles will be discussed in groups, feedback will be collected in an open class discussion, Identifying clear and concise writing,.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Explain different principles, types and perspectives of communication	C2	PLO12
2	Demonstrate effective speaking communication skills using various speaking modes e.g. speech, argument, discussions etc	A2	PLO10
3	Demonstrate effective written communication skills by writing essays, emails and reports	A2	PLO10

Recommended Books:

Text Book(s):
- Ferguson.(2004).Communication skills .OUP Oxford

Reference Book(s):
- Etherton, A..(2002).General Certificate English (1st edition,) .Crown Business
- Eastwood, J..(2013).English Practice Grammar O.U.P (4th edition) .Willey
- Ellen, K..(2013).Maximize Your Presentation Skills: How to Speak, Look and Act on Your Way to the Top (1ST edition) .Crisp Publications
- David Beer & David McMurrey, Wiley(2014).A guide to writing for Engineers (3rd Edition) .Kendall Hunt Publishing
- Mandel, S..Effective Presentation Skills: A Practical Guide Better Speaking (2nd Edition) Islamic International Publication House
- Schwartzman. R.(2008).Fundamentals of Oral Communication .Dar-us-Salam Publications

Course Title: Islamic Studies
Course Code: ISL 101
Prerequisite: None
Credit Hours: 2
Contact Hours: 2

Course Content: Pre-Islamic society in Arabia, The early life and character of Muhammad (pbuh) , The development of Islam , The main events of the Prophet's life and his significance in Muslim beliefs , Reflection on the example of the Prophet (pbuh) – as a role model for the early Muslims and for individuals and communities today , Knowledge and understanding of the prescribed Suras and Hadith , The importance, application and significance of texts in the lives of Muslims today , The lives of four prophets, as recounted in the Qur'an , Teachings, implications and examples that might be drawn from these stories today , The Caliphate Period and the Four Pious Caliphs , The significance of the Caliphate period for the development of Islam and as a model for Muslim society , The structure and history of the Qur'an , The classification and use of Hadith , Use, application and significance of Qur'an and Hadith, including to Muslim life today , Articles of faith and The Five Pillars , Jihad - in its range of meanings , Id festivals and rites of passage – birth, marriage and funeral rites , The contribution and benefits of beliefs and observances to the faith and actions of individuals and communities

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Define the fundamental concepts of Islam and also discuss the teachings of Holy Quran and Sunnah	C1	PLO8
2	Explain the socio cultural background of Islam, with practical examples of the life of Holy Prophet (saww).	C2	PLO8
3	solve the problems of contemporary issues, highlighting the teachings of Quran and Sunnah By using the sources of Islamic law.	C3	PLO8
4	Present a religious topic confidently and professionally.	A2	PLO10

Recommended Books:

Text Book(s):

- Dr.Bilal Philips.(2012).Islamic Studies (10th Edition) .Pearson

Reference Book(s):

- Safi-ur-Rahman al-Mubarkpuri .(2009).The Sealed Nector (4th edition.) .Pearson

Course Title: Linear Algebra
Course Code: GSC 121
Prerequisite: None
Credit Hours: 3
Contact Hours: 3

Course Content: A brief introduction of the concept of groups , rings & fields, vector space, Subspace of vector space, Linear combination, Span, basis and dimension of vector spaces, Linearly independence & dependence of vectors, Linear Transformations, Properties of linear transformations, kernel (null space) & range of a linear transformation, Eigen values and Eigen vectors, Eigen values of triangular matrices, - Diagonalization of matrices.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Define fundamental concepts of linear algebra.	C1	PLO1
2	Apply techniques for solving linear transformations.	C3	PLO2
3	Solve linear equations, matrices and determinant problems.	C3	PLO2

Recommended Books:

Text Book(s):

- Robert Beezer.(2000).A first course in linear algebra (4th Edition) .Pearson

Reference Book(s):

- Jim Hefferon..Linear Algebra (10th Edition) .Wiley

Course Title: Occupational Health and Safety
Course Code: ENV 101
Prerequisite: None
Credit Hours: 1
Contact Hours: 1

Course Content: This course introduces the student to the study of workplace occupational health and safety. The student will learn safe work practices in offices, industry and construction as well as how to identify and prevent or correct problems associated with occupational safety and health in these locations as well as in the home. The course will cover contents related to:

- Health and Safety Foundations
- Fostering a Safety Culture
- Recognizing and Communicating Hazards
- Finding Hazard Information
- Accidents & Their Effect on Industry
- Assessing and Minimizing the Risks from Hazards
- Preparing for Emergency Response Procedures
- Stress and Safety at Work environment
- Importance of investigation

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Explain that safety standards that must be maintained in compliance with regulatory requirements of Engineering for maintaining a sustainable environment.	C2	PLO7
2	Demonstrate an understanding of workplace injury prevention, risk management and incident investigations.	C3	PLO7
3	Present the policies, procedures and equipment needed to deal with hazardous environment.	A2	PLO7

Recommended Books:

Textbook:

- S. Z. Mansdorf, "Handbook of Occupational Safety and Health", John Wiley & Sons, Third Edition, 2019.
- David Allan Galloway, "Safety WALK Safety TALK: How small changes in what you THINK, SAY, and DO shape your safety culture", CreateSpace Independent Publishing Platform, 2019.
- Occupational safety and health law handbook by Ogletree, Deakins, Nash, Smoak and Stewarts, second edition, 2008.
- The Manager's Guide to Health & Safety at Work by Jeremy Stranks, 8th edition, 2006.
- The A-Z of health and safety by Jeremy Stranks, 2006.

Course Title: Data Structure and Algorithms
Course Code: CSC 210
Prerequisite: CSC 113
Credit Hours: 3
Contact Hours: 3

Course Content: Abstract data types, complexity analysis, Big O notation, Stacks (linked lists and array implementations), Recursion and analyzing recursive algorithms, divide and conquer algorithms, Sorting algorithms (selection, insertion, merge, quick, bubble, heap, shell, radix, bucket), queue, dequeuer, priority queues (linked and array implementations of queues), linked list & its various types, searching an unsorted array, binary search for sorted arrays, hashing, open addressing and chaining, trees and tree traversals, binary search trees, heaps, M-way tress, balanced trees, graphs, breadth-first and depth-first traversal, topological order, shortest path, adjacency matrix and adjacency list implementations

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Describe basic data structures and relevant standard algorithms.	C1	PLO1
2	Demonstrate working of different algorithms and processes of data structures	C3	PLO2
3	Design different algorithms for data structures operations	C5	PLO3
4	Analyze and compare algorithms for efficiency.	C4	PLO2

Recommended Books:

Text Book(s):

- Mark Allen Weiss..Data Structures and algorithm analysis in C (3rd Edition) .Jones And Bartlett Publishers

Reference Book(s):

- Nell Dale.(2017).C++ Plus Data Structures (4th Edition,) .Springer
- Richard Neapolitan & Kumarss Naimipour..(1997).Foundations of Algorithms Using C++ Pseudocode .Wiley

Course Title: Data Structures and Algorithm Lab
Course Code: CSL 221
Prerequisite: CSL 210
Credit Hours: 1
Contact Hours: 3

Course Content: This course introduces the formal concepts of data structures, algorithms, and their interrelationships. This course also develops skills in the design of algorithms and data types and introduces abstract methods for analyzing and comparing data structures-and algorithms. At the end of this course students will be familiar with a range of important data structures and algorithms to develop computing solutions to various problems. Contents include Introduction to Data Structures, Introduction to Algorithms, Arrays, Searching Techniques, Sorting Techniques, Stacks, Recursion, Queues, Linked List, Trees, and Graphs

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Practice different task related to different Data structures and their algorithms.	P3	PLO5
2	Display project management skills in creating solutions for database projects in team environment.	A5	PLO11
3	Design & implement small scale project using Data structures components and algorithms learned in Lab	P4	PLO3
4	Display the spirit of self-reliance to complete the lab journal timely and professionally.	A5	PLO 9
5	Show the ability to act upon a sequence of setups pertaining to designing data structures and algorithms in response to given scenarios.	P2	PLO 5

Course Title: Software Requirement Engineering
Course Code: SEN 211
Prerequisite: SEN 120
Credit Hours: 3
Contact Hours: 3

Course Content: Introduction to Requirements Engineering, Introduction to System Engineering, what are requirements? What is a requirements document? Kinds of Software Requirements (Functional, Non-Functional, Domain, Inverse, Design and Implementation Requirements, A generic process for requirements engineering, System modelling for requirements engineering, Requirements Analysts – Knowledge, Skills and Tasks, Software Requirements Development, Requirements documents, Sources of Requirements, Requirements elicitation, Requirements Management, Requirements Identification Techniques, Change Management, Requirements Traceability, Classifications of Requirements Traceability, Traceability Information, Policies, and Techniques, User Stories, Story Mapping, Stories On Board – A tool to map stories, KANBAN – A tool to understand requirements, Requirements Engineering Implementation in Scrum, Requirements Engineering Implementation in Agile.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Describe various software requirement needs for a variety of stakeholders/situations	C1	PLO1
2	Apply requirements engineering activities & processes to any given situation	C3	PLO2
3	Analyze various requirements engineering tools & techniques suitable for a given situation	C4	PLO2
4	Compile a software requirement specification document	C5	PLO3
5	Apply project management tools and techniques to initiate, plan, and manage a project	C3	PLO11

Recommended Books:

Text Book(s):

Elizabeth Hull, Ken Jackson, Jeremy Dick.Requirements Engineering (5th Edition) .Wiley

Reference Book(s):

Ian Sommerville .Requirements Engineering - A Good Practice Guide (3rd Edition) .Pearson

Course Title: Probability and Statistics
Course Code: GSC 122
Prerequisite: None
Credit Hours: 3
Contact Hours: 3

Course Content: Introduction to Statistics and Data Analysis, Statistical Inference, Samples, Populations, and the Role of Probability. Sampling Procedures. Discrete and Continuous Data. Statistical Modeling. Types of Statistical Studies. Probability: Sample Space, Events, Counting Sample Points, Probability of an Event, Additive Rules, Conditional Probability, Independence, and the Product Rule, Bayes' Rule. Random Variables and Probability Distributions. Mathematical Expectation: Mean of a Random Variable, Variance and Covariance of Random Variables, Means and Variances of Linear Combinations of Random Variables, Chebyshev's Theorem. Discrete Probability Distributions. Continuous Probability Distributions. Fundamental Sampling Distributions and Data Descriptions: Random Sampling, Sampling Distributions, Sampling Distribution of Means and the Central Limit Theorem. Sampling Distribution of S2, t-Distribution, F-Quantile and Probability Plots. Single Sample & One- and Two-Sample Estimation Problems. Single Sample & One- and Two-Sample Tests of Hypotheses. The Use of P-Values for Decision Making in Testing Hypotheses (Single Sample & One- and Two-Sample Tests), Linear Regression and Correlation. Least Squares and the Fitted Model, Multiple Linear Regression and Certain, Nonlinear Regression Models, Linear Regression Model Using Matrices, Properties of the Least Squares Estimators.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Explain the basic concepts of probability and statistics used for data representation and sampling	C2	PLO1
2	Apply basic statistical techniques and probability theory for decision making and for solving problems	C3	PLO2
3	Compare various probabilistic and statistical analysis techniques and their usage in science and engineering	C4	PLO1

Recommended Books:

Text Book(s):

- Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying E. Ye,.(2014).Probability and Statistics for Engineers and Scientists (5th Edition) .McGraw-Hill Education

Reference Book(s):

- Anthony J. Hayter, Duxbury Press.(2016).Probability and Statistics for Engineers and Scientists (12th edition,) . Cengage Learning
- John Schiller, R. Alu Srinivasan and Murray Spiegel..Schaum's Outline of Probability and Statistics (6th Edition) McGraw-Hill Education

Course Title: Computer Architecture and Logic Design
Course Code: CEN 220
Prerequisite: None
Credit Hours: 3
Contact Hours: 3

Course Content Computer Architecture and Logic Design are core concepts in computing and engineering programs, which aim to cultivate students' abilities towards the basic understanding of logic circuits, and the architecture of uniprocessor in terms of system performance. The course would cover the following topics: • Logic Gates. Expression of Digital Function in Boolean algebra. Canonical Forms; Standard Forms: SOP, POS. • Gate Level Minimization. K-map 2, 3, 4 variables maps. • Full Adder and Half Adder Circuits. 4-bit Binary Adder. • Combinational Circuits, Decoder, Encoder, Multiplexer • Sequential Circuits. Latches: SR, D Latch. D Flip-flop JK Flip Flop, T Flip Flop: Characteristic Table, characteristic equations. • Design Process of Synchronous Sequential Circuits. Design with D Flip Flops. • Design Process of Synchronous Sequential Circuits. Design with JK and T Flip Flops. Design of a synchronous Counter • Registers: Shift Register, Counters, Ripple and Synchronous Counters. • Instruction, Instruction Cycle. Addressing Modes. • CPU: Registers, Addressing Modes, Instruction Cycle • Memory Organization • Input Output Organization. • Assembly Language

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Describe the fundamental concepts of digital systems, Boolean algebra and logic gates, combination logic and MSI circuits, sequential logic circuits, memories and programmable logic devices	C1	PLO1
2	Apply different binary operations; minimize expressions using Boolean algebraic rules and K-map techniques	C3	PLO1
3	Define the general architecture of a computer system and its organization	C1	PLO1
4	Understand and classify the major components of a computer system architecture, their purposes and interactions	C2	PLO1
5	Solve the problems that help them evaluate the performance parameters for the given hardware architecture	C3	PLO2

Recommended Books:

Text Book(s):

• William Stallings. (2009).Computer Organization & Architecture .Springer

Reference Book(s):

• David A. Patterson & John L. Hennessy.(2001).Computer Organization and Design .Wiley

Course Title: Computer Architecture and Logic Design Lab
Course Code: CEL 220
Prerequisite: None
Credit Hours: 1
Contact Hours: 3

Course Content: The Lab would cover the following topics: Logic Gates. Expression of Digital Function in Boolean algebra. Canonical Forms; Standard Forms: SOP, POS. Gate Level Minimization. K-map 2, 3, 4 variables maps. Full Adder and Half Adder Circuits. 4-bit Binary Adder. Combinational Circuits, Decoder, Encoder, Multiplexer Sequential Circuits. Latches: SR, D Latch. D Flip-flop JK Flip Flop, T Flip Flop: Characteristic Table, characteristic equations

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Follow the instructions to Perform different programmable logics in VVM and MIPS using Modern tools.	P3	PLO5
2	Display the spirit of self-reliance to complete the lab journal timely and professionally.	A5	PLO9
3	Show the ability to act upon a sequence of setups pertaining to the tasks related to Computer Architecture and Logic Design Lab concepts	P2	PLO5
4	Design & construct logical systems for specific requirements.	P4	PLO3
5	Display project management skills and objective based approach to develop solutions in a teamwork environment.	A5	PLO11

Course Title: Pakistan Studies and Global Perspective
Course Code: PAK 103
Prerequisite: None
Credit Hours: 2
Contact Hours: 2

Course Content: Historical and Ideological Perspective, Constitution of Pakistan, Contemporary Pakistan, Economy of Pakistan, Land of Opportunities, Pakistan's Foreign Policy, Pakistan in pursuit of Global Agenda

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Explain the rationale for the creation of Pakistan.	C2	PLO8
2	Enable students to contribute in social, political and economic growth of Pakistan.	C4	PLO6
3	Analyze the issues of governance, politics and crisis facing Pakistan Today.	C4	PLO6
4	Play an active role toward sustainable development of Pakistan in global perspective	C4	PLO7

Recommended Books:

Text Book(s):

- Khalid B. Sayeed, Pakistan: The Formative Phase 1857 – 1948, Pakistan, Publishing House, 1960.

Reference Book(s):

- Gulam Allana, Quaid-e-Azam: the story of Pakistan, Ferozsons, 1967.
- Shahid M. Amin, Pakistan's Foreign Policy: A Reappraisal, Oxford University Press, 2010.
- S. Akbar Zaidi, Issues in Pakistan's economy, Oxford University Press, 2003.
- Hamid Khan, Constitutional & political history of Pakistan, Oxford University Press, 2003.

Course Title: Operating System
Course Code: CSC 320
Prerequisite: CEN 220
Credit Hours: 3
Contact Hours: 3

Course Content: An overview of Computer System: Basic elements, Instruction execution, Interrupts, Memory hierarchy; Introduction to operating system: objectives and functions, evolution, modern operating systems, architectures; Process description & Control: Process control blocks, Process states, Process creation & termination, Two and five state models, Suspended processes, Process control structures and attributes; Uniprocessor Scheduling: Types of Scheduling, Scheduling Algorithms; Threads: Multithreading, User level & Kernel-level threads; Concurrency: Mutual Exclusion & Synchronization: Principles of concurrency, Race condition, Process interaction and requirements, Semaphores, Producer/Consumer problem, Reader/Writer problem; Deadlock & Starvation: Principles of Deadlock, Reusable/Consumable resources, Resource allocation graph, Deadlock conditions, prevention, avoidance and detection; Memory management: Paging & Segmentation, Relocation, protection, sharing, logical organization, Fixed partitioning, Dynamic-partitioning.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Describe the fundamental concepts of operating systems, including the internal structure, design and its working mechanisms.	C1	PLO1
2	Explain the concepts and working mechanism related to the techniques and methodologies that an operating system uses to control and manage system resources.	C2	PLO1
3	Solve problems related to algorithms used in the operating system in order to satisfy the functional and performance requirements.	C3	PLO2
4	Analyze the concepts and working phenomena behind certain operating system algorithms and techniques.	C4	PLO1
5	Investigate a cutting-edge topic in relation to Operating Systems by surveying credible and recent literature.	C4	PLO4

Recommended Books:

Text Book(s):

- William Stallings.Operating Systems- Internals and Design Principles (9th Edition.) .Pearson

Reference Book(s):

- Abraham Silberschatz, Peter B. Galvin & Greg Gagne.(2012).Operating Systems Concepts (4th Edition.) .Thomson Brooks/Cole

Course Title: Operating System Lab
Course Code: CSL 320
Prerequisite: CEL 220
Credit Hours: 1
Contact Hours: 3

Course Content: An overview of Computer System: Basic elements, Instruction execution, Interrupts, Memory hierarchy; Introduction to operating system: objectives and functions, evolution, modern operating systems, architectures; Process description & Control: Process control blocks, Process states, Process creation & termination, Two and five state models, Suspended processes, Process control structures and attributes; Uniprocessor Scheduling: Types of Scheduling, Scheduling Algorithms; Threads: Multithreading, User level & Kernel-level threads; Concurrency: Mutual Exclusion & Synchronization: Principles of concurrency, Race condition, Process interaction and requirements, Semaphores, Producer/Consumer problem, Reader/Writer problem; Deadlock & Starvation: Principles of Deadlock, Reusable/Consumable resources, Resource allocation graph, Deadlock conditions, prevention, avoidance and detection; Memory management: Paging & Segmentation, Relocation, protection, sharing, logical organization, Fixed partitioning, Dynamic-partitioning.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Practice the implementation guidelines related to Linux shell and interact with OS subsystem using shell commands, C programs in gcc compiler.	P3	PLO5
2	Display project management skills in creating solutions for Operating system projects in team environment.	A5	PLO11
3	Design & implement Operating system projects for specific requirement.	P4	PLO3
4	Display the spirit of self-reliance to complete the lab journal timely and professionally.	A5	PLO8
5	Show the ability to act upon a sequence of setups pertaining to design Operating system applications in response to given scenarios.	P2	PLO5

Course Title: Design & Analysis of Algorithms
Course Code: CSC 321
Prerequisite: CSC 221
Credit Hours: 3
Contact Hours: 3

Course Content: The course mainly covers the study of designing and analyzing algorithms. Introduction; role of algorithms in computing, Analysis on nature of input and size of input Asymptotic notations; Big-O, Big Ω, Big Θ, little-o, little-ω, Sorting Algorithm analysis, loop invariants, Recursion and recurrence relations; Algorithm Design Techniques, Brute Force Approach, Divide-and-conquer approach; Merge, Quick Sort, Greedy approach; Dynamic programming; Elements of Dynamic Programming, Search trees; Heaps; Hashing; Graph algorithms, shortest paths, sparse graphs, String matching, Branch & Bound Techniques.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Describe the basic concepts related to design and analysis of algorithms	C1	PLO1
2	Explain the working mechanism of algorithmic design paradigms and approaches	C2	PLO1
3	Design algorithms in pseudocode of given problems	C3	PLO3
4	Analyze the asymptotic performance of the algorithms	C4	PLO2

Recommended Books:

Text Book(s):

- Jeff Erickson.(2019).Algorithms .Pearson
- Knebl.(2020).Algorithms and Data Structures: Foundations and Probabilistic Methods For Design and Analysis .PHI Learning

Reference Book(s):

- Berman K.A, & Paul, J. L..(2012).Foundations and Design Strategies (3rd Edition) .The MIT Press
- Stephens, R..(2014).Essential Algorithms: A Practical Approach to Computer Algorithms. (2nd Edition) .
- Cormen, T. H.(2012).Introduction to Algorithms .Springer

Course Title: Database Management Systems
Course Code: CSC 220
Prerequisite: CSC 113
Credit Hours: 3
Contact Hours: 3

Course Content: Basic database concepts, relational data model, attributes, schemas, tuples, domains, relation instances, keys of relations, integrity constraints, relational algebra, selection, projection, Cartesian product, types of joins, normalization, functional dependencies, normal forms, entity relationship model, entity sets, attributes, relationship, entity-relationship diagrams, Structured Query Language (SQL), Joins and sub-queries in SQL, Grouping and aggregation in SQL, concurrency control, database backup and recovery, indexes, NoSQL systems.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Define database concepts like Data Models, functional dependencies, transaction processing, concurrency control and recovery techniques	C1	PLO1
2	Explain the concepts and working mechanism related to Data Models, dependencies, normalization, and transactions	C2	PLO1
3	Apply appropriate database techniques such as relation algebra, SQL queries, Transaction management, and concurrency management to create solution for different problems	C3	PLO2

4	Design an appropriate database structure for a given business scenario using methods such as:
	    1. Entity relationship diagrams &
	    2. Database normalization.
		C5	PLO3

Recommended Books:

Text Book(s):

- Carlos Coronel, Steven Morris and Peter Rob.(2017).Database Systems: Design, Implementation, and Management (13th Edition,) .Addison-Wesley

Reference Book(s):

- Abraham Silberschatz, Henry F. Korth S. Sudarshan.Database System Concepts (7th Edition) .Pearson

- C. J. Date..Database Systems (6th Edition) .Pearson

- R. Elmasri and S. Navathe.(2000). Fundamentals of Database Systems .Morgan Kaufmann Pub

- T.Connolly and C.Begg.(2011).Database Systems, a Practical Approach to Design, Implementation and Management (1st Edition,) .Cambridge University Press

- Philip Greenspun.(2015).SQL for Web Nerds (8th Edition,) .McGraw-Hill Education

Course Title: Database Management System Lab
Course Code: CSL 220
Prerequisite: CSL 113
Credit Hours: 1
Contact Hours: 3

Course Content: This course is to focus on the technical aspects of database to provide a foundation in data management concepts. It includes representing information with the relational database model. Learn and apply the Structured Query Language (SQL) for database definition (DDL) and manipulation (DML). Create applications and connect them with backend (database).

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Practice the implementation guidelines related Structured Query Language (SQL) for database definition and manipulation using DBMS.	P3	PLO5
2	Display project management skills in creating solutions for database projects in team environment.	A5	PLO11
3	Design & implement database projects according to the specific front-end and back-end requirements.	P4	PLO3
4	Display the spirit of self-reliance to complete the lab journal timely and professionally.	A5	PLO8
5	Show the ability to act upon a sequence of setups pertaining to designing databases in response to given scenarios.	P2	PLO5

Course Title: Software Design & Architecture
Course Code: SEN 221
Prerequisite: None
Credit Hours: 2
Contact Hours: 2

Course Content: This course will expose students to the concepts, principles, and state-of-the-art methods and use of UML in object-oriented analysis, software design, software pattern and software architecture, including domain-specific software architectures, architectural styles, their properties and the types of problems for which they are most appropriate, and architecture-based testing and analysis. The course also examines the practical applicability of architecture research, specifically its relationship to work in architectural frameworks and component interoperability platforms such as .NET. Particular emphasis will be given on adopting object oriented analysis and design in software engineering.

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Define fundamental concepts related to software design are architecture.	C1	PLO1
2	Describe various architectural and design styles and patterns suitable for a given scenario.	C2	PLO1
3	Apply design models using modeling and object-oriented programming languages.	C3	PLO3
4	Analyze the suitability of various architectural styles and design patterns in relation to a given situation.	C4	PLO2
5	Design object oriented design models to reflect implementation details.	C5	PLO3

Recommended Books:

Text Book(s):

- Brahma Dathan, Sarnath Ramnath .Object-Oriented Analysis, Design and Implementation (Latest Edition) .Universities Press

Reference Book(s):

- Roger S. Pressman, Bruce R. Maxim.Software Engineering: A Practitioner's Approach (8th Edition) . McGraw-Hill Education
- Gorton I.Essential Software Architecture, (Latest Edition) .Springer – Verlag
- Eric Freeman, Elisabeth Freeman.(1988).Head First Design Patterns .Pearson College Div

Course Title: Software Design & Architecture Lab
Course Code: SEL 221
Prerequisite: None
Credit Hours: 1
Contact Hours: 3

Course Content: This course teaches the principles and concepts involved in the analysis and design of large software systems. Below, are the learning objectives:
• Express the analysis and design of an application using UML
• Specify functional semantics of an application using OCL
• Specify and evaluate software architectures
• Select and use appropriate architectural styles
• Understand and apply object-oriented design techniques
• Select and use appropriate software design patterns
• Understand and perform a design review

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Reproduce the implementation of design & architecture tasks as demonstrated.	P3	PLO5
2	Demonstrate self-reliance when working independently or in group activities involving design, architecture, and development.	A5	PLO11
3	Manipulate design & architecture tasks to improve or modify as needed for the situation at hand..	P4	PLO3
4	Display commitment and academic honesty pertaining to the assigned tasks	A5	PLO 9
5	Respond effectively on a variety of situations involving hands-on skills.	P2	PLO 5

Course Title: Computer Communication & Networking
Course Code: CEN 223
Prerequisite: None
Credit Hours: 3
Contact Hours: 3

Course Content: The main goal of the course is to teach the principles of Computer communication and networking. The course is designed to provide the fundamental concepts about the layered architecture of the network, including the OSI and TCP/IP reference models. The layered architecture is beneficial for comprehending the design and maintenance of different kind of data networks, while reducing complexity. Theoretical concepts are augmented with lab experiments while using latest network simulation and visualization tool, namely Cisco Packet Tracker, which in turn would help in strengthening both conceptual and practical capabilities of the student. Upon completion of this course, the students will have sound knowledge of Computer communication, transmission media, network models, networking protocols, transport layer protocols, internet standards, network application and introductory knowledge on state-of-the-art research topics in this field. Furthermore, the course aims to develop engineering approach within the students for solving real-life challenges.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Describe the fundamental concepts of TCP/IP layered model, network topologies, wired and wireless media, analog and digital signals, data-link protocols, error detection/correction, channel access mechanisms, IP addressing, routing algorithms, reliable and unreliable transmissions and application layer protocols.	C1	PLO1
2	Explain the concepts and working mechanism related to network topologies, multiplexing, switched networks, classful and classless IP addressing, routing algorithms, and transport and application layer protocols.	C2	PLO1
3	Solve problems related to network topologies, analog and digital signals, switched networks, error detection, CDMA, IP addressing, sub-networking and routing algorithms.	C3	PLO2
4	Analyze the concepts and working phenomena behind certain communication and networking technology.	C4	PLO1
5	Design network topologies, sub networks and IP addresses distribution for different scenarios.	C5	PLO3
6	Investigate the paradigm behind the Internet of Things by surveying credible and recent literature.	C4	PLO4

Recommended Books:

Text Book(s):

- Behrouz A. Forouzan..Data Communications and Networking (6th Edition) .Pearson

Reference Book(s):

- William Stallings..Data and Computer Communications (5th Edition) .Morgan Kaufmann

- James Kurose and Keith Ross..Computer Networking: A Top-Down Approach (5th Edition) .Prentice Hall

- Larry L. Peterson and Bruce S. Davie, Morgan Kaufmann..(2011).Computer Networks: A Systems Approach (1st Edition) .McGraw-Hill Education

- Andrew S. Tanenbaum and David J. Wetherall, Pearson.(2009).Computer Networks (2nd Edition,) Addison Wesley

- Ying-Dar Lin, Ren-Hung Hwang, Fred Baker..Computer Networks: An Open Source Approach (2nd Edition) Wiley

Course Title: Computer Communication and Networking
Course Code: CEL 223
Prerequisite: None
Credit Hours: 1
Contact Hours: 3

Course Content: The lab course deals with the fundamental concepts of TCP/IP layered model, network topologies, wired and wireless media, analog and digital signals, data link protocols, error detection/correction, channel access mechanisms, IP addressing, routing algorithms, reliable and unreliable transmissions and application layer protocols.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Follow the instructions to design communication networks of varying topologies and protocols along with configuring different network components in switches, routers, servers and end-devices.	P3	PLO5
2	Display the spirit of self-reliance to complete the lab journal timely and professionally.	A5	PLO9
3	Show the ability to act upon a sequence of setups pertaining to designing and configuring communication networks in response to given scenarios.	P2	PLO5
4	Design & implement a network-based solution for solving a real-life complex problem or that can be used as a service in a real-world environment.	P4	PLO3
5	Display project management skills and objective based approach to develop networking solutions in a teamwork environment.	A5	PLO11

Course Title: Formal Methods in Software Engineering
Course Code: SEN 323
Prerequisite: GSC 110
Credit Hours: 3
Contact Hours: 3

Course Content: This course provides a hands-on introduction to formal methods for software engineering. The purpose of formal methods is to enable the construction of highly reliable software. Their foundation is the precise specification of run-time properties that a software system is expected to satisfy. Formal methods are concerned with specifications that are precise for being stated in languages endowed with a formal syntax, semantics, and theory. Formality helps the specification process in at least two ways:

1. It naturally leads to unambiguous, high-quality specifications, and
2. It provides the bases for automated tool support.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Describe how formal methods (FM) helps to produce high quality software	C1	PLO1
2	Transform informal specification into formal specification	C3	PLO2
3	Interpret and evaluate the results of the analysis	C6	PLO4
4	Analyze main approaches in formal software verification	C4	PLO2

Recommended Books:

Text Book(s):

- Grassman.logic and discrete mathematics: a computer science perspective (1ST Edition) .Wiley

Reference Book(s):

- Thompson, Simon Haskell.The craft of functional programming, international computer science series (2nd Edition) .Humana

Course Title: Software Construction
Course Code: SEN 311
Prerequisite: None
Credit Hours: 2
Contact Hours: 2

Course Content: Software Construction introduces fundamental principles and techniques of software development, i.e., students will be able to have the skills to develop a small to medium scale software from scratch, formulating and analyzing the problem to be solved, exploring and articulating candidate designs, how to write software that is safe from bugs, easy to understand, and ready for change. The course includes problem sets and a final project. Important topics include specifications and invariants; testing; abstract data types; design patterns for object-oriented programming; concurrent programming and concurrency; testing and reasoning to insure quality and functional programming.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Describe the role of design and its major activities within the Object Oriented software development process.	C1	PLO1
2	Devise Object- oriented design models and refine them to reflect implementation details.	C5	PLO3
3	Analyze different architecture for medium size software.	C4	PLO4
4	Implement design model using and object-oriented programming language.	C3	PLO3

Recommended Books:

Text Book(s):

- Jeffery D. Ullman..Compilers: Principles, Techniques and Tools (2nd Edition) .Pearson

Reference Book(s):

- Daniel I.A. Cohen.(2001).Introduction to Computer Theory .The Caravan Book House
- Jeffery D. Ullman..Introduction to Automata Theory, Languages and Computation (1st Edition) .Rehbar Publishers

Course Title: Software Construction Lab
Course Code: SEL 311
Credit Hours: 1
Prerequisite: SEL 221

Lab Content: This lab focuses on providing hands-on experience in designing and developing small-scale software systems with emphasis on the use of automated analysis tools and techniques that enable small-scale software development. Students will generate concrete software engineering artifacts at all stages of the software life-cycle. Design principles and methods for small-scale software system development; design and modeling tools; collaborative development environment; object-oriented design and analysis; design patterns and refactoring; integration and testing tools; debugger and bug-finder; program comprehension; unit testing; program verification; static and dynamic program analysis.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Follow the instructions to design software applications using the concepts of code by design; object-oriented design translations into object-oriented code i.e., abstraction, modularity, and concurrency, software design patterns, error free programming, unit, and integration testing, debugging.	P3	PLO5
2	Display the spirit of self-reliance towards the completion and submission of lab journal timely and professionally.	A5	PLO11
3	Show the ability to act upon a sequence of steps pertaining to designing and configuring the important concepts of object- oriented design translations into object-oriented code in response to given scenarios.	P2	PLO3
4	Design and construct optimized, error free, and reusable, code as a developer using the techniques of software construction which solve real word complex problems, or it can be used as a service in real life environment.	P4	PLO8
5	Display project management skills and objective-based approach to develop a software system as a team by using appropriate documentation, programming, testing, and integration tools and techniques.	A5	PLO5

Course Title: Software Quality Engineering
Course Code: SEN 321
Prerequisite: SEN 120
Credit Hours: 3
Contact Hours: 3

Course Content: This course aims to equip the students with a good grasp of software quality metrics and models. The students would learn software testing techniques and software reliability analysis techniques. The following is an itemized list of objectives:

- To introduce quality assurance and quality control techniques and develop a QA plan and Test Plan
- To be able to document and report the findings
- To carry out inspections and carry out testing in a production environment

This course introduces the student fundamental notions of software quality and the techniques used to build and check quality in software systems. A particular emphasis is placed on quantitative assessment of software quality and quality control using software testing techniques. The students would not only be introduced with the theoretical background of these concepts but they would also be given hands-on experience of applying these concepts. The assignments would be planned carefully to enhance students' learning of applying the learnt concepts from practical standpoint.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Define fundamental elements, attributes, metrics, and techniques associated with software testing and quality assurance.	C1	PLO1
2	Describe core concepts and principles of software testing and software quality assurance in relation to the real scenarios.	C2	PLO1
3	Demonstrate the use of software testing techniques/test cases appropriate for a given situation.	C3	PLO3
4	Analyze various software testing techniques and tools suitable for a given scenario.	C4	PLO2
5	Prepare a comprehensive test plan to document testing strategies/SQA process implementation activities.	C5	PLO3

Recommended Books:

Text Book(s):

- S, Jeff Tian.(2014).software Quality Engineering Testing, Quality Assurance, and Quantifiable Improvement (2nd Edition) .Wiley

Reference Book(s):

- Daniel Galin.Software Quality: Concepts and Practice (Latest Edition) .Wiley
- Paul Ammann and Jeff Offutt,..Introduction to Software Testing (Latest Edition) .Cambridge University Press.
- Gerard O'Regan,Introduction to Software Quality, (Latest Edition) .Springer International,

Course Title: Human Computer Interaction
Course Code: SEN 212
Prerequisite: None
Credit Hours: 3
Contact Hours: 3

Course Content: Introduction to HCI, The Human, Understanding And Conceptualizing Interaction, User Interviews, Lean Research Techniques, Interaction Design Basics, Usability Metrics, Designing, Prototyping, and Construction, User Support, Cognitive Models, Usability.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Describe fundamental concepts of Human Computer Interaction.	C1	PLO1
2	Apply techniques and usability heuristics on interface designing.	C3	PLO2
3	Create a variety of prototypes and user guides.	C5	PLO2

Recommended Books:

Text Book(s):

- Wiley Peerce, Rogers, Sharp..Interaction Design, Beyond Human Interaction (6th Edition) .Pearson
- Alan Dix, Janet E. Finlay, Gregory D. Abowd,   .(2012).Human-Computer Interaction (3rd Edition) .Congruent Press

Reference Book(s):

- Shneiderman..Designing the User Interface: Strategies for Effective Human-Computer Interaction (3rd Edition) . Orthogonal Publishing L3C

Course Title: Technical Writing & Presentation Skills
Course Code: HSS 320
Prerequisite: None
Credit Hours: 3
Contact Hours: 3

Course Content: Written Communication, Organized writing of communicative paragraphs, Coherence and cohesive devices, Correctness of Language, Importance of clarity in writing, Directness, Brevity, Pitfalls to avoid, Hackneyed phrases, Redundancies, Slang, Passive voice, E-language, Sentence length, Specific Words and concrete words, Types of memos, Minutes of a meeting, Etiquettes of emailing Resume and cover letter writing, Applications and follow-up letters, Business Letters: Format, Elements, Language to avoid, Analysis of sample letters, Practice exercises on different types of official correspondence, Handling the interview, Investigating about the company, Making good appearance, Anticipating questions and preparing answers, Making oneself at ease – increasing confidence level, Successful preparation of an interview, Phonetics and Phonology, Phonetic symbols, Transcribing, Assimilation and elision, Use of dictionary, Stress patterns Intonation (practice in reading skills), Vocabulary Building Techniques of building word power, Importance of reading, Correct word usage, Synonyms, Ladder of accuracy, Words easily confused, Words with dual function. Written Reports, Daily reports, Research methodology, Types of reports, Formal and informal reports, Executive summary, Scope, Purpose, Introduction, Writing the main report, Conclusion, Bibliography, APA and MLA styles, Plagiarism, Presentations and Seminars

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Describe instruments and types of writing for effective technical communication.	C1	PLO10
2	Explain the techniques utilized to effectively communicate the technical knowledge.	C2	PLO10
3	Demonstrate skills in technical writing by writing effectively for a variety of professional situations.	C3	PLO12

Recommended Books:

Text Book(s):

- Gerald J. Alred,Charles T. Brusaw, Walter E. Oliu.(2017).Handbook of Technical Writing (14th Edition,) .Pearson

Reference Book(s):
- Zane K. Quible, Margaret H. Johnson and Dennis L. Mott.(1997).Introduction to Business Communication (7th Edition) .McGraw-Hill Inc.
- Courtland L. Bovée, John V. Thill and Barbara E. Schatzman.(1882).Business Communication Today .McGraw-Hill Companies
- Herta A. Murphy, Herbert W. Hildebrandt and Jane P. Thomas..Effective Business Communication (5th Edition) .McGraw-Hill Education

- Lani Arredondo..Business Presentation (8th Edition) .Pearson

Course Title: Cloud Computing
Course Code: SEN 401
Prerequisite: None
Credit Hours: 2
Contact Hours: 2

Course Content: The course will introduce this domain and cover the topics of cloud infrastructures, virtualization, software defined networks and storage, cloud storage, and programming models. As an introduction, we will discuss the motivating factors, benefits and challenges of the cloud, as well as service models, service level agreements (SLAs), security, example cloud service providers and use cases.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Define the fundamental concepts of cloud computing.	C1	PLO1
2	Analyze problem requirements to recognize what type of data and processes are involved in a cloud computing solution.	C2	PLO2
3	Apply and develop business centric models on cloud based IT resources.	C3	PLO3
4	Present the updated technologies evolving in the field of Cloud Computing	A2	PLO9

Recommended Books:

Text Book(s):

- Rajkumar Buyya, Christian Vecchiola "Mastering Cloud Computing", mcgraw Hill
- Thomas erl, "cloud computing concepts, technology and architecture", 1st ed., 2014, pearson.

Reference Book(s):

- ronald l. krutz and russell dean vines, "cloud security-a comprehensive guide to secure cloud computing", 2013, wiley.
- BARRIE SOSINKY, "CLOUD COMPUTING", 1ST ED., 2014, WILEY.
- **"Cloud Computing:** Principles and Paradigms", John Wiley & Sons
- "Developing Cloud Applications with Windows Azure Storage", Microsoft Press

Course Title: Cloud Computing Lab
Course Code: SEL 401
Prerequisite: None
Credit Hours: 1
Contact Hours: 3

Course Content: The major objectives for this course are to learn the basic concepts of service development and data access strategies using the .NET platform. Course will also deal with Extend HTTP services using ASP.NET Core. Host services on-premises and in Microsoft Azure. Deploying services to both on-premises and cloud environments and managing the interface and policy for their services.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Follow the instructions to implement the concepts of .net core, HTTP request, Web API and entity Frame work using cloud computing modern Tools	P3	PLO5
2	Display the spirit of self-reliance to complete the lab journal timely and professionally.	A5	PLO9
3	Respond effectively w.r.t given scenarios related to implementation of different Cloud Computing Concepts.	P2	PLO5
4	Design & implement net core, HTTP request, Web API and entity Frame work based solution for solving a real-life complex problem or that can be used as a service in a real-world environment.	P4	PLO 3
5	Display project management skills and objective based approach to develop Cloud Computing based solutions in a teamwork environment.	A5	PLO 11

Course Title: Software Project Management
Course Code: SEN 410
Prerequisite: SEN 120
Credit Hours: 3
Contact Hours: 3

Course Content: Introduction to SPM, Discussion: Why Projects Fail, What Is a Project?, What Is a Project Management?, Understanding Knowledge management Areas, Managing Creeps, Understanding the Project Management Process Groups, Introducing Project Management Life Cycles, Agile Project Management Approaches, Extreme Project Management Approach, How to Scope a Project, Planning and Conducting the Project Scoping Meeting, Writing an Effective Project Overview Statement, How to Plan a Project, Building the Work Breakdown Structure, Six Methods for Estimating Task Duration, Estimating Resource Requirements, Estimating Cost Constraints, Using the Lag Variable, Managing Project on MS Office Project Management, How to Launch a Project, Establishing Team operating Rules, Scope Change Management Process, How to Monitor and Control a Project, Earned Value Analysis, Problem Escalation Strategies, How to Close a Project, Writing the Final Report, Agile Project Management, User Stories, Planning Poker Technique, Scrum Framework, Lean Mindset, Value Stream Mapping, Managing Project on Jira, Functional Point Analysis, Constructive Cost Model – COCOMO, PERT Analysis.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Describe the main concepts of Software Project Management	C1	PLO1
2	Compare & Explain various SPM techniques involved in project management life cycle.	C2	PLO1
3	Apply project management tools and techniques to initiate, plan, and manage a project	C3	PLO11
4	Investigate size, cost, duration and efficiency of a project for a given scenario	C6	PLO4
5	Present clearly and professionally in front of audience	A2	PLO10

Recommended Books:

Text Book(s):

- Robert K. Wysocki,(2004).Effective Project Management - Traditional, Agile, Extreme (3rd Edition,) .Project Management Institute
- Bob Hughes Mike Cotterel.(2005).Software Project Management .O'Reilly Media

Reference Book(s):

- Project Management Institute.(2014).A Guide to the Project Management Body of Knowledge .McGraw-Hill Higher Education
- Jennifer Greene, Andrew Stellman.(2012).Applied Software Project Management . Cengage Learning

Course Title: Information Security
Course Code: CSC 407
Prerequisite: None
Credit Hours: 3
Contact Hours: 3

Course Content: The goal of the course is to teach students the fundamentals of information security and their applications for achieving Confidentiality, Integrity and Availability of Information Systems. Students will learn the foundation needed, from both technical and managerial aspects, required for securing IT based systems. The course is designed to provide concepts about types of security attack and learn methods to detect and prevent attack incidents. Several state-of-the-art cryptography techniques will also be covered along with their application as a central solution for securing information systems. The course would also touch several topics pertaining to several important security systems, such as Antiviruses, Firewalls, Intrusion detection/prevention systems and Honey Pots. Furthermore, the course aims to develop engineering approach within the students for solving real-life complex problems pertaining to information security.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Describe the fundamental concepts in information security, CIA triad, security attacks, security services, symmetric/asymmetric cryptography, security policies, security standards and their impact over modern software applications.	C1	PLO1
2	Explain the concepts and working mechanism of various methods available to protect existing systems, including modern operating and computing systems.	C2	PLO1
3	Solve a variety of numerical problems pertaining to modern information security mechanisms and techniques.	C3	PLO2
4	Analyze security vulnerabilities, risks and security requirements.	C4	PLO1
	Investigate the application of information security solution in current and future technologies by surveying credible and recent literature.	C4	PLO4

Recommended Books:

Text Book(s):

- Principles of Information Security (6th Edition), Michael E. Whitman and Herbert J. Mattord, latest Edition, Cengage Learning

Reference Book(s):

- Computer Security: Principles and Practice (4th Edition), William Stallings and Lawrie Brown, Pearson, 2017.
- Cryptography and Network Security: Principle and Practice (7th Edition), William Stallings, Pearson, 2017.
- Cryptography and Network Security (3rd Edition), B. Forouzan and D. Mukhopadhyay, Mc-Graw Hill, 2015.
- Security in Computing (5th Edition), Charles Pfleeger, Shari Pfleeger and Jonathan Margulies, Prentice Hall, 2015.

Course Title: Numerical Analysis
Course Code: GSC 321
Prerequisite: GSC 110
Credit Hours: 3
Contact Hours: 3

Course Content: Number Systems, Floating Point Number Systems, Round-off Errors and Computer Arithmetic, The Bisection Method, The Secant Method, False-Position Method, Fixed-Point Iteration, Newton-Raphson Method, Muller's Method, Error Analysis for Iterative Method, Gaussian Elimination Method, Jacobi's Method, Gauss-Siedel Iterative Method, Introduction to MATLAB. Introduction to MATLAB, Relaxation Method, Eigenvalues Problem, Eigenvectors, Interpolation, Lagrange Polynomials, Newton Polynomials, Divided Differences, Hermite Interpolation, Numerical Differentiation, Richardson's Extrapolation Method, Numerical Integration, Trapezoidal Rule, Simpson's 1/3Rule, Simpson's 3/8Rule, Romberg's Integration, Ordinary Differential Equations, Euler's Method, Modified Euler's Method, Taylor's Series Method, Runge-Kutta (R-K) Method, Second-Order R-K Method, Fourth-Order R-K Method, Predictor-Corrector Method, Milne's Predictor-Corrector Method, Least Square Regression, Simple Linear Regression, Multiple Linear Regression.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Describe familiarity with different numerical algorithms	C1	PLO1
2	Solve numerical methods in algebraic equations (mathematical forms).	C4	PLO2
3	Identify solutions of various numerical problems	C3	PLO4
4	Present computer-based solutions for numerical algorithms	A2	PLO9

Recommended Books:

Text Book(s):

- Burden, R.L., Faires D.J. & Burden A.M.(2013).Numerical Analysis .Wiley

Reference Book(s):

- Hildebrand, F.B..(2013).Introduction to Numerical Analysis (3rd Edition) .s k kataria

Course Title: Numerical Analysis Lab
Course Code: CEL 220
Prerequisite: None
Credit Hours: 1
Contact Hours: 3

Course Content: Numerical Analysis Lab will cover following content:
Find the roots of non-linear equation using bisection method, to find the roots of non-linear equation using newton's method. Curve fitting by least – square approximations. To solve the system of linear equations using gauss - elimination method. To solve the system of linear equations using gauss - seidal iteration method, to solve the system of linear equations using gauss - jorden method. To integrate numerically using trapezoidal rule. To integrate numerically using simpson's rules, to find the largest eigen value of a matrix by power - method. To find numerical solution of ordinary differential equations by euler's method. To find numerical solution of ordinary differential equations by runge- kutta method. To find numerical solution of ordinary differential equations by milne's method. To find the numerical solution of laplace equation to find the numerical solution of wave equation and to find the numerical solution of heat equation.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Follow the instruction to perform different task related to mathematical functions and equation	P3	PLO5
2	Display project management skills in creating solutions for project.	A5	PLO11
3	Construct small scale project using different mathematical equation	P4	PLO3
4	Show the professional commitment towards originality and timely submission of deliverables e.g lab files and reports.	A5	PLO8

Multi-Disciplinary Engineering Elective (MDEE) Courses

Course Title: Digital Design
Course Code: CEN 120
Prerequisite: None
Credit Hours: 2
Contact Hours: 2

Course Content: This Course is an introductory course in Digital Logic Design. Principles and concepts of a digital system are taught to lay the foundation to all other computer hardware courses. Covered topics would include Introduction to Digital Systems, Boolean algebra and Logic Gates, Combinational Logic and MSI Circuits, Sequential Logic Circuits, Latches, Flip-Flops and their applications, Adders, Multiplexers, Counters, Shift Registers, and simple Arithmetic Logic Unit (ALU). Design and implementation of combinational circuits in Verilog.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Describe the fundamental concepts of digital systems, Boolean algebra and logic gates, combination logic and MSI circuits, sequential logic circuits, memories and programmable logic devices	C1	PLO1
2	Apply different binary operations; minimize expressions using Boolean algebraic rules and K-map techniques	C3	PLO2
3	Design and perform analysis digital circuits for the provided expressions	C4	PLO3

Recommended Books:

Text Book(s):

- Thomas L. Floyd.(2007).Digital Fundamentals (6th Edition) .McGraw-Hill School Pub Co

Reference Book(s):

- M. Morris Mano. .(2016).Digital Design, (12th Edition,) .Pearson
- Albert Paul Malvino et al.Digital Principles and Applications (2nd Edition) .Pearson
  Ronald J. Tocci et al .Digital Systems – Principles and Applications (6th Edition) .Jones & Bartlett Learning

Course Title: Digital Design Lab
Course Code: CEL 120
Prerequisite: None
Credit Hours: 1
Contact Hours: 3

Course Content: This Course is an introductory course in Digital Logic Design. Principles and concepts of a digital system are taught to lay the foundation to all other computer hardware courses. Covered topics would include Introduction to Digital Systems, Boolean algebra and Logic Gates, Combinational Logic and MSI Circuits, Sequential Logic Circuits, Latches, Flip-Flops and their applications, Adders, Multiplexers, Counters, Shift Registers, and simple Arithmetic Logic Unit (ALU). Design and implementation of combinational circuits in Verilog.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Follow the instructions to simulate both combinational and sequential circuits using a variety of techniques.	P3	PLO5
2	Display the spirit of self-reliance to complete the lab journal timely and professionally.	A5	PLO9
3	Show the ability to act upon a sequence of steps pertaining to implement small-scale digital circuits	P2	PLO5
4	Design & construct a project using combinational and sequential Logic.	P4	PLO3
5	Display project management skills and objective based approach to develop networking solutions in a teamwork environment.	A5	PLO11

Course Title: Introduction to Bio-Informatics
Course Code: CSC 448
Prerequisite: None
Credit Hours: 3
Contact Hours: 3

Course Content: Scope and challenges of Bioinformatics, DNA, RNA, Proteins, Central dogma of life, Bioinformatics Algorithms, Biological vs Computer Algorithms, Biological databases, Sequence submission, Molecular Biological Data Retrieval, Sequence Formats, Genome Informatics, Prokaryotic and Eukaryotic Genomes, Epichromosomal elements (EEs), Transposable Elements (TEs), Genome Analysis, Eukaryotic Gene Structure, Comparative Proteomics, Horizontal Gene Transfer, Cloning Techniques, Human Genome Project (HGP), Sequencing Techniques, Next Generation Sequencing (NGS), Genome Sequencing, Effect of Repeats, Assembly Algorithms, Introduction to Statistics, Maximum Likelihood Estimation, Binomial Distribution, Normal Distribution, Markov Chains, Probabilities in Markov Models, Markov Chain Model, Markov Chains for Discrimination, Gene Prediction, Pattern Finding in a Genome, Pattern Finding Algorithms, Pair-Wise Sequence Alignment, Optimal Alignment Methods, Needleman-Wunsch Algorithm, Pair-Wise Sequence Alignment, Needleman-Wunsch Execution, Smith-Waterman Algorithm, Dynamic Programming Algorithm, DOT PLOT, FASTA Algorithm, BLAST, Doing BLAST locally, P Value, Extreme value Distribution (EVD), Hidden Markov Models, MSA, Phylogenetic, RNA and related concepts, Microarray, RNAseq, Data Analysis, Gene Networks

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Describe the fundamental concepts of Bio-Informatics for software engineering	C1	PLO1
2	Explain and compare the working mechanism of Bio-Informatics algorithms.	C2	PLO1
3	Present Bio-Informatics topic confidently and professionally	A2	PLO9
4	Implement Bio-Informatics algorithms	C3	PLO2

Recommended Books:

Text Book(s):

- Peter Clote.(2019).Computational Molecular Biology: An Introduction (1st Edition) .Cambridge University Press

Reference Book(s):

- Jonathan M Keith.(2018).Bioinformatics volume I Data, Sequence Analysis and Evolution .Packt Publishing

Course Title: Robotics
Course Code: CEN 463
Prerequisite: None
Credit Hours: 2
Contact Hours: 2

Course Content: This course provides an overview of robot mechanisms, dynamics, and intelligent controls. Topics include planar and spatial kinematics, and motion planning; mechanism design for manipulators and mobile robots, multi-rigid-body dynamics, 3D graphic simulation; control design, actuators, and sensors; wireless networking, task modeling, human-machine interface, and embedded software.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Describe the fundamental concepts of robot mechanisms, dynamics, and intelligent controls	C1	PLO1
2	Explain and compare the working mechanism of manipulators and mobile robots, multi-rigid-body dynamics, 3D graphic simulation; control design, actuators, and sensors; wireless networking, task modeling, human-machine interface, and embedded software	C2	PLO1
3	Design and fabricate working robotic systems in a group-based term project	C5	PLO3

Recommended Books:

Text Book(s):

- Steven L. Brunton, J. Nathan Kutz.(2007).Data-Driven Science and Engineering Machine Learning, Dynamical Systems, and Control .Wiley

Reference Book(s):

- Danny Staple.(2009).Learn Robotics Programming: Build and control autonomous robots using Raspberry Pi 3 and Python (1ST Edition,) .Prentice Hall

Course Title: Robotics Lab
Course Code: CEL 463
Prerequisite: None
Credit Hours: 1
Contact Hours: 3

Course Content: This course provides an overview of robot mechanisms, dynamics, and intelligent controls. Topics include planar and spatial kinematics, and motion planning; mechanism design for manipulators and mobile robots, multi-rigid-body dynamics, 3D graphic simulation; control design, actuators, and sensors; wireless networking, task modeling, human-machine interface, and embedded software.

Course Learning Outcomes:

CLO	Statement	Blooms Taxonomy	Associated PLO
1	Give an implementation concepts complying the concepts of Robotics	P3	PLO5
2	Demonstrate project management skills in creating solutions for project. Construct and demonstrate the digital electronic principles to interpret experimental findings.	A5	PLO11
3	Perform the task using C and UNIX fundamentals.	P4	PLO3
4	Show the professional commitment towards submission of lab files and project reports	A5	PLO8
5	Adapt the implementation concepts related to digital circuits in different scenarios	P2	PLO5

Course Title: Theory of Automata
Course Code: CSC 315
Prerequisite: None
Credit Hours: 3
Contact Hours: 3

Course Content: Finite State Models: Language definitions preliminaries, Regular expressions/Regular languages, Finite automata (FAs), Transition graphs (TGs), NFAs, Kleene's theorem, Transducers (automata with output), Pumping lemma and non-regular language Grammars and PDA. Decidability. Turing Machines Theory: Turing machines, Post machine, Variations on TM, TM encoding, Universal Turing Machine, Defining Computers by TMs

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Define the core concepts of automata theory and formal languages.	C1	PLO1
2	Describe a regular language by using various methods like set formal method, regular expressions and finite automata.	C2	PLO1
3	Apply transformation between multiple representations of a regular language.	C3	PLO3
4	Analyze the given lexeme with respect to the given model of formal language.	C4	PLO2

Recommended Books:

Text Book(s):

- Zvi Kohavi and Niraj K Jha.(1977).Switching and Finite Automata Theory .Crane Russak & Co

Reference Book(s):

- Michael A Harrison.(1995).Introduction to Switching and Automata Theory (Systems Science) (1st Edition) .Pearson
- Abraham Kandel.(2007).Fuzzy Switching and Automata: Theory and Applications# (Computer Systems Engineering Series) (2nd Edition,) .Addison Wesley

Course Title: Embedded System Design
Course Code: CEN 439
Prerequisite: None
Credit Hours: 2
Contact Hours: 2

Course Content: Introduction to Embedded Systems, Applications of Embedded Systems, Embedded Processors and Microcontrollers, Architecture and Design, Von Neumann and Harvard Architecture, Addressing Modes and Instruction Set, Special Function Registers, Memory mapped and I/O mapped peripherals, Parallel Port (PP) Interface, Serial Port (SP) Interface, Timers and Counters, Interrupts, Interrupt and Polling based systems, Analog to Digital (A/D) Conversion, Pulse Width Modulation (PWM) Technique, Embedded Software Development Tools and Languages, Debugging Embedded Software, Serial Peripheral Interface (SPI), Inter-integrated Circuit (I2C) Protocol, Embedded Operating Systems

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Explain the working principle of hardware interfaces of an embedded system and configure them considering the requirements of a problem	C2	PLO1
2	Apply the knowledge and techniques in designing an embedded system that incorporates the microprocessor/microcontroller and hardware peripherals	C3	PLO3

Recommended Books:

Text Book(s):

- Kai Qian, David Den Haring and Li Cao.(2006).Embedded Software Development with C (2nd Edition,) .O'Reilly Media

Reference Book(s):

- Frank Vahid and Tony Givargis.(2015).Embedded System Design: A Unified Hardware/Software Approach (10th Edition,) .Cengage Learning
- Michael Barr and Anthony Massa.(2013).Programming Embedded Systems with C and GNU Development Tools (2nd Edition) .Dover Publications

Course Title: Embedded System Design Lab
Course Code: CEL 439
Prerequisite: None
Credit Hours: 1
Contact Hours: 3

Course Content: Introduction to Embedded Systems, Applications of Embedded Systems, Embedded Processors and Microcontrollers, Architecture and Design, Von Neumann and Harvard Architecture, Addressing Modes and Instruction Set, Special Function Registers, Memory mapped and I/O mapped peripherals, Parallel Port (PP) Interface, Serial Port (SP) Interface, Timers and Counters, Interrupts, Interrupt and Polling based systems, Analog to Digital (A/D) Conversion, Pulse Width Modulation (PWM) Technique, Embedded Software Development Tools and Languages, Debugging Embedded Software, Serial Peripheral Interface (SPI), Inter-integrated Circuit (I2C) Protocol, Embedded Operating Systems

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Build code of Proteus and Arduino application implementing concepts of Embedded System	P3	PLO5
2	Demonstrate project management skills in creating solutions for project.	A5	PLO11
3	Design & implement Embedded System projects according to the specific requirements.	P4	PLO3
4	Show the professional commitment towards originality and timely submission of deliverables e.g lab files and reports.	A5	PLO8
5	Adapt the skills to perform the task related to Embedded System concepts and techniques.	P2	PLO5

Course Title: Differential Equations
Course Code: GSC 210
Prerequisite: GSC 110
Credit Hours: 3
Contact Hours: 3

Course   Content: Ordinary   Differential   Equations   of   the   First   Order: Geometrical Considerations, Isoclines, Separable Equations, Equations Reducible to Separable Form, Exact Differential Equations,   Integrating   Factors,   Linear   First-Order   Differential   Equations,   Variation   of   Parameters. Ordinary   Linear   Differential   Equations;   Homogeneous   Linear   Equations   of   the   Second   Order, Homogeneous   Second-Order   Equations   with   Constant   Coefficients,   General   Solution,   Real   Roots, Complex Roots, Double Root of the Characteristic Equation, Differential Operators, Cauchy Equation, Homogeneous Linear Equations of Arbitrary Order, Homogeneous Linear Equations of Arbitrary Order with Constant Coefficients, Non-homogeneous Linear Equations. Modeling of Electrical Circuits. Systems of Differential Equations. Series Solutions of Differential Equations. Partial Differential Equations: Method of Separation of variables, wave, Heat & Laplace equations and their solutions by Fourier series method.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Identify, analyze and subsequently solve physical situations whose behavior can be described by ordinary differential equations.	C1	PLO1
2	Application of differential equations in Software Engineering	C3	PLO3
3	Analyze the Method of Separation of variables, wave, Heat & Laplace equation and their solutions by Fourier series method.	C2	PLO2

Recommended Books:

Text Book(s):

- Michael Greenberg.Advanced Engineering Mathematics (7th Edition) .McGraw-Hill Education

Reference Book(s):

- Erwin Kreyzig.Advanced Engineering Mathematics (44th Edition) .

Course Title: Complex Variables and Transforms
Course Code: GSC 220
Prerequisite: GSC 110
Credit Hours: 3
Contact Hours: 3

Course Content: The following topics are covered in the course: complex algebra and functions; analyticity; contour integration, Cauchy's theorem; singularities, Taylor and Laurent series; residues, evaluation of integrals; multivalued functions, potential theory in two dimensions; Fourier analysis and Laplace transforms.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Define the basics of complex numbers and its rules.	C1	PLO1
2	Explain the transformations techniques available for Complex functions and variables.	C2	PLO1
3	Solve the complex problems and prove the results by using derivatives and integration processes.	C3	PLO2
4	Analyze the results in the breaking form.	C4	PLO2

Recommended Books:

Text Book(s):

- J. W. Brown &R.V. Churchill.Complex Variables And Applications (9th Edition) .McGraw-Hill Education

Reference Book(s):

- BS.Grewal.Advanced Engineering and Mathematics (10th Edition) .Mc Graw Hill

Course Title: Operations Research
Course Code: GSC 445
Prerequisite: GSC 122
Credit Hours: 3
Contact Hours: 3

Course Content: Operations research (OR) has many applications in science, engineering, economics, and industry and thus the ability to solve OR problems is crucial for both researchers and practitioners. Being able to solve the real life problems and obtaining the right solution requires understanding and modeling the problem correctly and applying appropriate optimization tools and skills to solve the mathematical model. The goal of this course is to teach you to formulate, analyze, and solve mathematical models that represent real-world problems. We will also discuss how to use EXCEL and LINDO for solving optimization problems. In particular, we will cover linear programming, network flow problems, integer programs, nonlinear programs, dynamic programming and queuing models

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Define the basics of Operations Research and its rules	C1	PLO1
2	Explain and compare optimization techniques	C2	PLO1
3	Solve the mathematical models and real life problems by applying appropriate optimization tools.	C3	PLO2

Recommended Books:

Text Book(s):

- Fredrick S.Hiller..Introduction to operations research (3rd Edition) .Academic Press

Reference Book(s):

- Lieberman ,Nag, Basu Hillier ..Introduction to operations research (1st Edition) .CRC Press

Course Title: Simulation and Modeling
Course Code: CEN 450
Prerequisite: GSC 122
Credit Hours: 3
Contact Hours: 3

Course Content: Introduction to Modeling and Simulation (IM/S) provides an introduction into modeling and simulation approaches, covering continuum methods (e.g. finite element analysis), atomistic simulation (e.g. molecular dynamics) as well as quantum mechanics. Atomistic and molecular simulation methods are new tools that allow one to predict functional material properties such as Young's modulus, strength, thermal properties, color, and others directly from the chemical makeup of the material by solving Schroedinger's equation (quantum mechanics). This approach is an exciting new paradigm that allows to design materials and structures from the bottom up — to make materials greener, lighter, stronger, more energy efficient, less expensive; and to produce them from abundant building blocks. These tools play an increasingly important role in modern engineering! In this subject you will get hands-on training in both the fundamentals and applications of these exciting new methods to key engineering problems.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Define the basics of Simulation and Modeling	C1	PLO1
2	Explain and compare Simulation and Modeling techniques available	C2	PLO1
3	Solve the Simulation and Modeling problems and prove the results	C3	PLO2

Recommended Books:

Text Book(s):

- Bernard P.Zeigler, Alexander Muzy .(2005).Theory of Modeling and Simulation (3rd Edition) .Benjamin Cummings

Reference Book(s):

- Gabriel A. Wainer, Pieter J. Mosterman.(2008).Discrete-Event Modeling and Simulation: Theory and Applications (7th Edition,) .engage Learning

Course Title: Simulation and Modeling Lab
Course Code: CEL 450
Prerequisite: GSC 122
Credit Hours: 1
Contact Hours: 3

Course Content: Introduction to Modeling and Simulation (IM/S) provides an introduction into modeling and simulation approaches, covering continuum methods (e.g. finite element analysis), atomistic simulation (e.g. molecular dynamics) as well as quantum mechanics. Atomistic and molecular simulation methods are new tools that allow one to predict functional material properties such as Young's modulus, strength, thermal properties, color, and others directly from the chemical makeup of the material by solving Schrodinger's equation (quantum mechanics). This approach is an exciting new paradigm that allows to design materials and structures from the bottom up — to make materials greener, lighter, stronger, more energy efficient, less expensive; and to produce them from abundant building blocks. These tools play an increasingly important role in modern engineering! In this subject you will get hands-on training in both the fundamentals and applications of these exciting new methods to key engineering problems.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Give an implementation concepts complying the concepts of Simulation and Modelling software	P3	PLO5
2	Demonstrate project management skills in creating solutions for project under specific requirements ability to construct and transform real-life model related problems into productive solution.	A5	PLO11
3	Perform the task using Simulation and Modelling fundamentals	P4	PLO3
4	Show the professional commitment towards submission of lab files and project reports	A5	PLO8
5	Adapt the implementation concepts of Simulation and Modelling to perform the task Related to developing model for a given scenario.	P2	PLO5

Course Title: Physics II
Course Code: GSC 446
Prerequisite: GSC 114
Credit Hours: 3
Contact Hours: 3

Course Content: This is a continuation of Applied Physics, the introductory course on the principles and methods of physics for students who have good preparation in physics and mathematics. This course covers electricity, magnetism, optics and quantum mechanics.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Explain the fundamental laws of physics relevant to the engineering sciences (i.e. mechanical, electrical engineering etc.)	C2	PLO1
2	Apply knowledge of basic physical laws to solve various problems of applied nature	C3	PLO2
3	Analyze different physical problems using the laws of physics from different areas like mechanics and thermodynamics	C4	PLO2

Recommended Books:

Text Book(s):

- Fishbane, Paul M., Stephen Gasiorowicz, and Stephen T. Thornton.(1998).Physics for Scientists and Engineers with Modern Physics (3rd Edition) .Addison-Wesley

Reference Book(s):

- Serway, Raymond A., and John W. Jewett.(2012).Physics for Scientists and Engineers (2nd Edition) .Springer
- Wolfson, Richard .(2006).Physics with Modern Physics for Scientists and Engineers (2nd Edition,) . Chapman and Hall/CRC

Course Title: Stochastic Processes
Course Code: GSC 440
Prerequisite: GSC 122
Credit Hours: 3
Contact Hours: 3

Course Content: Discrete Markov chains, classification of states, first passage and recurrence times, absorption problems, stationary and limiting distributions. Chapman-Kolmogorov equations, Long run behavior of Markov chains, Absorption probabilities and expected times to absorption, Statistical aspects of Markov chains, The mover-stayer model, Application of a Markov chain and mover-stayer model to modeling repayment behavior of bank loans' grantees. Markov Processes in continuous time: Poisson processes, birth-death processes. Poisson process The Kolmogorov differential equations, Limiting behavior of continuous time Markov chains The Q matrix, forward and backward differential equations, imbedded Markov Chain, stationary distribution. renewal theory, Brownian Motion and its generalizations, Discrete time martingales, Conditional expectation, Definition of a martingale and examples, Optional stopping theorem, Stochastic calculus.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Define the basics of Stochastic Processes	C1	PLO1
2	Explain and compare Markov chains, random walks, martingales, and Galton-Watsom tree	C2	PLO1
3	Solve the complex problems and prove the results by using probability theory and linear algebra	C3	PLO2

Recommended Books:

Text Book(s):

- Durrett, Richard.(2004).Essentials of stochastic processes (1st Edition,) .Springer

Reference Book(s):

- G.F. Lawler.(2010).Introduction to Stochastic Processes .Springer

Course Title: Business Process Automation
Course Code: SEN 449
Prerequisite: SEN 120
Credit Hours: 3
Contact Hours: 3

Course Content: Business Process Definitions, Business Process Analysis and Modelling, Business Process Lifecycle, Policies, Procedures and Rules (in terms of business processes), Role of People, Customers, Trading Partners and Suppliers in Business Processes, Business Process Simulation, Business Process Re-Engineering (objectives and techniques), Basic concepts of Six Sigma (in terms of business process improvement)

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Discover the various technologies that support Business Process Management	C2	PLO1
2	Analyze the performance of existing processes and identify process improvement	C4	PLO2
3	Propose business solutions in written and verbal forms for process innovation and redesign projects.	C3	PLO3

Recommended Books:

Text Book(s):

- August-Wilhelm Scheer , Ferri Abolhassan, Wolfram Jost , Mathias Kirchmer ..Business Process Automation (3rd Edition) .Addison-Wesley Professional

Reference Book(s):

- Hofstede, A.H.M.; van der Aalst, W.M.P. Adams.Business Process Automation (2nd Edition) .Prentice Hall

Course Title: System Programming
Course Code: CEN 449
Prerequisite: CSC 320
Credit Hours: 2
Contact Hours: 2

Course Content: Introduction to the Microsoft Windows ® Operating System, File Processing, Memory Management, Memory Mapped Files and DLLs, Process management, Threads and scheduling, Thread synchronization, Inter-process Communication, Input/Output, Device Drivers (USB or Parallel Port), File System Drivers, Filter Drivers

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Define the fundamental concepts of system programming	C1	PLO1
2	Explain different system programming theoretical and practical technique	C2	PLO1
3	Analyze different scenarios and design solution using system programming concepts.	C3	PLO3

Recommended Books:

Text Book(s):

- Johnson M. Hart.(1996).Windows System Programming .Pearson

Reference Book(s):

- Art Baker.(1999).The Windows NT Device driver .Addison-Wesley Professional

Course Title: System Programming Lab
Course Code: CEL 449
Prerequisite: CSL 320
Credit Hours: 3
Contact Hours: 3

Course Content: Introduction to the Microsoft Windows ® Operating System, File Processing, Memory Management, Memory Mapped Files and DLLs, Process management, Threads and scheduling, Thread synchronization, Inter-process Communication, Input/Output, Device Drivers (USB or Parallel Port), File System Drivers, Filter Drivers

Course Learning Outcomes:

CLO	Statement	Blooms Taxonomy	Associated PLO
1	Give an implementation concepts complying the concepts of System Programming	P3	PLO5
2	Demonstrate project management skills in creating solutions for project under specific requirements ability to construct and transform real-life C Application related problems into productive solution	A5	PLO11
3	Perform the task using C and UNIX fundamentals.	P4	PLO3
4	Show the professional commitment towards submission of lab files and project reports	A5	PLO8
5	Adapt the implementation concepts of c program applications to perform the task Related to developing c application for a given scenario.	P2	PLO5

Course Title: Fault Tolerant Systems
Course Code: SEN 429
Prerequisite: SEN 321
Credit Hours: 3
Contact Hours: 3

Course Content: Fault-tolerant systems are used in applications that require high dependability, such as safety-critical control systems in vehicles and airplanes, or business-critical systems for e-commerce, automatic teller machines and financial transactions. This is an introductory course that covers basic techniques for design and analysis of fault-tolerant systems, as well as project management and development processes for safety-critical systems. The course covers techniques for tolerating hardware and software faults, analysis of fault-tolerant systems, project management and development processes for safety-critical systems. The content can be divided into five areas:

1. Terminology and definitions.
2. Design techniques for fault-tolerance.
3. Analysis of fault-tolerant system.
4. Project management and development processes.
5. System examples.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Describe the fundamental concepts of Fault Tolerant Systems	C1	PLO1
2	Explain and compare Design techniques for fault-tolerance	C2	PLO2
3	Apply fault tolerance techniques for tolerating hardware and software faults.	C3	PLO3
4	Present Fault Tolerant Systems topic confidently and professionally	A2	PLO9

Recommended Books:

Text Book(s):

Robert S. Hanmer.(2017).Patterns for Fault Tolerant Software (1st Edition,) .Springer;

Course Title: Real Time Systems
Course Code: CEN 453
Prerequisite: CSC 320
Credit Hours: 3
Contact Hours: 3

Course Content: Programming languages intended for real time systems, support in ordinary programming languages, e.g. "Ada tasking", Real time operating system (RTOS), System support: scheduling, resource handling, Design and analysis of real time system software, Modelling and verification of real time systems, Reliability and fault tolerance, Interrupts, Fault recovery, Distributed real time systems, Real time communication, Real time systems for multiprocessor systems

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Explain fundamental principles for programming of real time systems with time	C2	PLO1
2	Describe the foundation for programming languages developed for real time programming	C1	PLO1
3	By using different technique design and develop real time system	C7	PLO3

Recommended Books:

Text Book(s):

- R Mall.(2009).Real Time Systems: Theory and Practice (3rd Edition,) . Cambridge University Press

Reference Book(s):

- K.C Wang.(1965).Embedded and Real-Time Operating Systems (1st Edition) .McGraw-Hill

Course Title: Compiler Construction
Course Code: CSC 323
Prerequisite: CSC 315
Credit Hours: 3
Contact Hours: 3

Course Content: High level languages and translators, phases of the compilation process, syntax and semantic specification of a language. Design and implementation of a lexical analyzer, top-down and bottom-up parsing strategies, ambiguous grammars, LL(k) and LR(k) grammars, recursive-descent and LL(1) parsing, left factoring and left recursion removal, simple precedence, SLR and LALR parsing. Semantic analysis, attributed grammars. Code generation from annotated parse tree. Code optimization.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Define the core concepts related to compiler and all of its components.	C1	PLO1
2	Design and implement parts of the compiler with respect to the given formal language by using various algorithms.	C3	PLO3
3	Select and use appropriate code generation and optimization techniques.	C4	PLO2
4	Evaluate the expressions and statements with respect to syntax and semantics of the underlying formal language.	C4	PLO2

Recommended Books:

Text Book(s):

- R Wilhelm and D Maurer.(2013).Compiler Design (International Computer Science Series) (1st Edition) .PHI

Reference Book(s):

- Alfred V Aho and Monica S Lam.(2004).Compilers: Principles, Techniques, & Tools with Gradiance (pkg) (1st Edition,) .Prentice-Hall of Pvt.Ltd
- James K L.(2016).Computer Hardware: Installation, Interfacing, Troubleshooting and Maintenance (1st Edition,) .Wiley

Course Title: Compiler Construction Lab
Course Code: CSL 323
Prerequisite: CSL 315
Credit Hours: 1
Contact Hours: 3

Course Content: High level languages and translators, phases of the compilation process, syntax and semantic specification of a language. Design and implementation of a lexical analyzer, top-down and bottom-up parsing strategies, ambiguous grammars, LL(k) and LR(k) grammars, recursive-descent and LL(1) parsing, left factoring and left recursion removal, simple precedence, SLR and LALR parsing. Semantic analysis, attributed grammars. Code generation from annotated parse tree. Code optimization.

Course Learning Outcomes:

CLO	Statement	Blooms Taxonomy	Associated PLO
1	Give an implementation concepts complying the concepts of Compiler	P3	PLO5
2	Demonstrate project management skills in creating solutions for project under specific requirements ability to construct and transform real-life compiler related problems into productive solution	A5	PLO11
3	Perform the task using compiler language	P4	PLO3
4	Show the professional commitment towards submission of lab files and project reports	A5	PLO8
5	Adapt the implementation concepts related to compiler in different scenarios	P2	PLO5

Course Title: Information Theory
Course Code: CSC 453
Prerequisite: GSC 110
Credit Hours: 3
Contact Hours: 3

Course Content: An introduction to the quantitative theory of information and its applications to reliable, efficient communication systems. Topics include mathematical definition and properties of information, source coding theorem, lossless compression of data, optimal lossless coding, noisy communication channels, channel coding theorem, the source channel separation theorem, multiple access channels, broadcast channels, Gaussian noise, and time-varying channels.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Describe the fundamental concepts of theory of information and its applications to reliable, efficient communication systems	C1	PLO1
2	Explain and compare mathematical definition and properties of information, source coding theorem, and lossless compression of data, optimal lossless coding, and noisy communication channels	C2	PLO2
3	Present Information Theory topic confidently and professionally	A2	PLO9

Recommended Books:

Text Book(s):

- E Dijkstra.(2000).A Discipline of Programming (Prentice-Hall Series in Automatic Computation) (1st Edition) .MIT Press

Reference Book(s):

- Noam Nisan and Shimon Schocken.(2016).The Elements of Computing Systems – Building a Modern Computer from First Principles .Creative Commons
- Elaine Svenonius.(2012).The Intellectual Foundation of Information Organization (Digital Libraries and Electronic Publishing) (10th Edition.) .Pearson

Course Title: IoT Application Development
Course Code: SEN 460
Prerequisite: None
Credit Hours: 2
Contact Hours: 2

Course Content: This course focuses on application development for IoTs. The salient topics included are introduction to embedded systems, Major hardware components of IoT, IoT operating systems, programming languages, Software architecture for IoT, Python for Raspeberry Pi, Node JS, Mircoservices for IoTs, Cloud services and cloud integration, Data Analytics, hardware interfacing,

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Describe the application areas of IOT	C1	PLO1
2	Explain the revolution of Internet in Mobile Devices, Cloud & Sensor Networks	C2	PLO1
3	Explain the building blocks of Internet of Things and their characteristics	C2	PLO1

Recommended Books:

Text Book(s):

- Peter Waher.(2010).Learning Internet of Things (3rd Edition,) .Pearson

Reference Book(s):

- Perry Lea..Internet of Things for Architects: Architecting IoT solutions by implementing sensors, communication infrastructure, edge computing, analytics, and security (2nd Edition) .McGraw-Hill

Course Title: IoT Application Development Lab
Course Code: SEL 460
Prerequisite: None
Credit Hours: 1
Contact Hours: 3

Course Content: This course focuses on application development for IoTs. The salient topics included are introduction to embedded systems, Major hardware components of IoT, IoT operating systems, programming languages, Software architecture for IoT, Python for Raspeberry Pi, Node JS, Mircoservices for IoTs, Cloud services and cloud integration, Data Analytics, hardware interfacing,

Course Learning Outcomes:

CLO	Statement	Blooms Taxonomy	Associated PLO
1	Give an explanation related to concepts of IoT Application Development.	P3	PLO5
2	Demonstrate project management skills in creating solutions for project. Design IoT Application for specific requirement.	A5	PLO11
3	Perform the task related to IoT Application.	P4	PLO3
4	Show the professional commitment towards submission of lab files and project reports	A5	PLO8
5	Adapt the skills to perform the task related to IOT concepts and techniques	P2	PLO5

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Engineering Electives Courses

Course Title: Web Engineering
Course Code: SEN 310
Prerequisite: CSC 113
Credit Hours: 2
Contact Hours: 2

Course Content: Web frameworks, types of web frameworks, server side, and client side and cross functional web frameworks, web framework features and architecture. Full stack web development using ASP.Net and MEAN framework. Web programming languages like HTML5, CSS 3, Java Script. Design principles of Web based applications, Platform as a Service (PaaS), responsive web design, web applications, browser/server communication, storage tier, cookies and sessions, input validation, multi-threaded request-response.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Describe web standards, frameworks, web applications modern protocols, programming concepts and control structures used in web engineering.	C1	PLO1
2	Explain programs written in web programming languages used by web frameworks.	C2	PLO1
3	Apply knowledge and understanding to solve interactive web engineering problems and project their solutions under specific requirements.	C3	PLO3
4	Analyze programs with respect to their performance, correctness, possible output, errors, and exceptions.	C4	PLO2

Recommended Books:

Text Book(s):

- Rajiv Chopra.(2016).Web Engineering .Phi

Reference Book(s):

- Emilia Mendes and Nile Mosley.(2010).Web Engineering .Springer
- Roger S. Pressman.(2008).Web Engineering: A Practitioners' Approach .Science Engineering & Math
- Danny Goodman.(2007).Dynamic HTML: The Definitive Reference: A Comprehensive Resource for XHTML, CSS, DOM, JavaScript (3rd Edition,) .O'Reilly Media;
- David Flanagan.(2014).JavaScript: The Definitive Guide (8th Edition) .O'Reilly Media;

Course Title: Web Engineering Lab
Course Code: SEL 310
Prerequisite: CSL 113
Credit Hours: 1
Contact Hours: 3

Course Content: Web frameworks, types of web frameworks, server side, and client side and cross functional web frameworks, web framework features and architecture. Full stack web development using ASP.Net and MEAN framework. Web programming languages like HTML5, CSS 3, Java Script. Design principles of Web based applications, Platform as a Service (PaaS), responsive web design, web applications, browser/server communication, storage tier, cookies and sessions, input validation, multi-threaded request-response.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Practice the implementation guidelines related web standards, web applications modern protocols, programming concepts and control structures used in web programming.	P3	PLO5
2	Display project management skills in creating solutions for web engineering projects in team environment.	A5	PLO11
3	Design & implement web engineering projects for specific requirement.	P4	PLO3
4	Display the spirit of self-reliance to complete the lab journal timely and professionally.	A5	PLO8
5	Show the ability to act upon a sequence of setups pertaining to design web applications in response to given scenarios.	P2	PLO5

Course Title: Software Re-Engineering
Course Code: SEN 411
Prerequisite: SEN 311
Credit Hours: 3
Contact Hours: 3

Course Content: Salient topics include the terminology and the processes pertaining to software evolution, fundamental re-engineering techniques to modernize legacy systems including source code analysis, architecture recovery, and code restructuring, software refactoring strategies, migration to Object Oriented platforms, quality issues in re-engineering processes, migration to network-centric environments, and software integration, reverse engineering, program comprehension, source code transformation and refactoring strategies, software maintenance and re-engineering economics.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Describe core concepts of software re-engineering that are involved in the examination and alteration of legacy systems to reconstitute them in a new form.	C1	PLO1
2	Explain the concepts and techniques of software re-engineering to create versions of existing programs that exhibit higher quality and better maintainability.	C2	PLO1
3	Apply software re-engineering process model and activities on a given scenario.	C3	PLO3
4	Differentiate the suitability of various software re-engineering techniques in relation to a given situation.	C4	PLO2

Recommended Books:

Text Book(s):

- Chris Birchall..Re-engineering Legacy Software (3rd Edition) .Pearson

Reference Book(s):

- Priyadarshi Tripathy and Kshirasaga Naik.(2008).Software Evolution and Maintenance: A Practitioner's Approach (6th edition,) .Pearson

Course Title: Artificial Intelligence
Course Code: CSC 411
Prerequisite: CSC 113
Credit Hours: 2
Contact Hours: 2

Course Content: The objective of this course is to provide students with fundamental concepts on Artificial Intelligence and Searching Algorithms by exploring the filed by its breadth. The course would cover an introduction to artificial intelligence, searching algorithms, logical agents, local search algorithms, adversarial search, first-order-logic, knowledge based agents and machine learning.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Describe and recall the fundamental concepts behind the approaches in artificial intelligence, intelligent agents, agent program types, uninformed search strategies, informed search strategies, heuristic functions, and supervised/unsupervised learning algorithms	C1	PLO1
2	Explain the concepts and working mechanism related to informed/ uninformed search algorithms, including local search strategies, adversarial search strategies and learning algorithms	C2	PLO1
3	Solve a variety of numerical problems related to different algorithms in AI.	C3	PLO2
4	Compare and analyze supervised (Neural Networks) and unsupervised learning (K-mean clustering) methods to solve a given problem.	C4	PLO2

Recommended Books:

Text Book(s):

- Stuart Russell and Peter Norvig..Artificial Intelligence: A modern Approach (4th edition) .pearson

Reference Book(s):

- George F. Luger .(2017).Artificial Intelligence: Structure & Strategies for Complex Problem Solving (7th Edition ,) .Pearson
- Patterson.(2015).Introduction to Artificial Intelligence & Expert System (3rd Edition,) .McGraw-Hill Education

Course Title: Artificial Intelligence Lab
Course Code: SEL 411
Prerequisite: CSL 221
Credit Hours: 1
Contact Hours: 3

Course Content: This course intended to provide understanding of Artificial Intelligence and implementation of AI Algorithms i.e. (Searching, Decisions, Genetic, etc.)

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Follow the instructions to implement informed/uninformed, local, adversarial and learning algorithms.	P3	PLO5
2	Display the spirit of self-reliance to complete the lab journal timely and professionally.	A5	PLO9
3	Design & implement an AI-based solution for solving a real-life complex problem.	P4	PLO3
4	Display project management skills and objective based approach to develop solutions in a teamwork environment.	A5	PLO 11

Course Title: Data Encryption and Security
Course Code: CEN 451
Prerequisite: None
Credit Hours: 3
Contact Hours: 3

Course Content: The main goal of the course is to teach the principles of data encryption techniques and their application in information security. The course is designed to provide concepts about several cryptography techniques and also touch concepts on few important security systems. The course would cover important topics including classical encryption, block chippers and Data Encryption Standard (DES), Advanced Encryption Standard (AES), block cipher, stream cipher, public-key cryptography, hash functions, message authentication code and digital signature. Furthermore, the course aims to develop engineering approach within the students for solving real-life challenges in information security.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Describe the fundamental concepts in data encryption, information security, CIA triad, security attacks, security services, symmetric/asymmetric cryptography, and their impact over modern software applications	C1	PLO1
2	Explain concepts and working mechanism of several symmetric and asymmetric encryption algorithms	C2	PLO1
3	Solve a variety of numerical problems related to classical encryptions, S-DES, AES, RSA and Hash functions	C3	PLO2
4	Compare/Justify the working phenomena behind certain data encryption techniques	C4	PLO1
5	Investigate the application of cybersecurity solution in current and future technologies by surveying credible and recent literature.	C4	PLO4

Recommended Books:

Text Book(s):

- W. Stallings.(2017).Cryptography and Network Security: Principle and Practice .Wiley

Reference Book(s):

- B. Forouzan and D. Mukhopadhyay.(2011).Cryptography and Network Security (3rd Edition,) .Morgan Kaufmann
- J. Bullock and J. T. Parker.(2011).Wireshark for Security Professionals .Morgan Kaufmann

Course Title: Data Mining
Course Code: CSC 452
Prerequisite: CSC 220
Credit Hours: 2
Contact Hours: 2

Course Content: This course discusses techniques for preprocessing data before mining and presents the concepts, online analytical processing (OLAP), and data generalization. It presents methods for mining frequent patterns, associations, and correlations. It also presents methods for data classification and prediction, data-clustering approaches, and outlier analysis.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Describe the fundamental concepts related to data mining	C1	PLO1
2	Explain and compare the techniques available for data mining	C2	PLO1
3	Solve data mining problems by using ML algorithm and statistical processes.	C3	PLO2
4	Present an advanced data mining topic confidently and professionally	A2	PLO9

Recommended Books:

Text Book(s):

- Han and Kamber.(2001).Data Mining Concepts and Techniques (Volume 1 & 2) .Wiley

Reference Book(s):

- Witten and Frank.(2016).Data Mining: Practical Machine Learning Tools and Techniques (1st Edition,) .Morgan Kaufmann
- James Silverton .(2014).Data Model Resource Book .Wiley
- Rajkumar Buyya, Rodrigo N. Calheiros , Amir Vahid Dastjerdi .(2014).Big Data, Principles and Paradigms .Pearson
- Dean.(2017).Big Data, Data Mining and Machine Learning (6th Edition,) .Pearson
- Tan, Steinbach and Kumar.(2014).Introduction to Data Mining .Career Education

Course Title: Data Mining Lab
Course Code: CSL 452
Prerequisite: CSL 220
Credit Hours: 1
Contact Hours: 3

Course Content: This Lab includes following Contents Working with OlAP (online analytical Processing), Python – Basic Operations, Python – Data Sets and libraries, Implementation of Decision Tree (Gini Index , Entropy) using python, Implementation of linear Regression using python, Implementing naïve bayes Algorithm using python, Implementing K Nearest Neighbor Algorithm using python, Implementing Neural Networks using python, Implementing K-Mean Clustering method using python, Exploring Knime (workflow , simple operation), Implementing Decision tree using knime , Implementing k-means clustering using knime , Implementing Logistic Regression using knime

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Follow the instructions to implement Machine Learning Algorithms using different dataset and libraries	P3	PLO5
2	Display and assure the self-reliance obligation to maintain the lab journal timely and professionally	A5	PLO9
3	Show the ability to perform a sequence of steps for implementing machine learning algorithms in response to a given scenario.	P2	PLO5
4	Design and develop data mining algorithms to solve real-time complex problems and implement them in real-world environment.	P4	PLO 3
5	Display objective based approach using project management skills to design and develop conceivable data mining solutions independently and as a teamwork.	A5	PLO 11

Course Title: Visual Programming
Course Code: CSC 313
Prerequisite: CSC 113
Credit Hours: 2
Contact Hours: 2

Course Content: An overview of the issues involved in the design and implementation of graphical user interfaces with windows and web based applications. A practical, hands-on course on how to program using the interactive, pointer-based, graphical techniques that comprise the modern desk-top interaction metaphor. Course will cover topics like .net assemblies, custom controls, .net remoting, dynamic custom controls, windows services, XML and .net, data access using ADO.net and LINQ, JSON, MVC.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Describe the fundamental concepts of .net Assembly, XML, ADO.net, JSON, .net remoting, Windows Services, and ASP.net MVC	C1	PLO1
2	Explain and compare the working mechanism of .net remoting, windows services, windows Azure, ASP.net MVC etc	C2	PLO1
3	By using advanced programming concepts, develop applications using ADO.net, .net Serialization, XML, .net remoting etc	C3	PLO3
4	Present an advanced programming topic confidently and professionally	A2	PLO9

Recommended Books:

Text Book(s):

- Deitel and Deitel.(2013).Visual C#: How to Program (1st Edition) .Microsoft Press

Reference Book(s):

- J.C. Bradley, A.C. Millspaugh.(2009).Programming in C# .NET (8th Edition,) .Pearson
- Sharp, J.(2013).Microsoft Visual C# Step by Step (Step by Step Developer) (5th Edition) .Morgan Kaufmann

Course Title: Visual Programming Lab
Course Code: CSL 313
Prerequisite: CSL 113
Credit Hours: 1
Contact Hours: 3

Course Content: This Lab includes following Contents Introduction to windows form application toolbox controls, Delegates & events, Creating Custom Controls, Creating dynamic Controls, Private Assembly in web form, Shared Assembly in web form, Serialization- Soap and Binary, XML, .NET Remotting, Create a simple data application by using ADO.NET, Windows form using SQL server, Creating a simple Asp.net Web form, LINQ- SQL and Objects

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Follow the instructions to implement the concepts of custom controls, delegates , serialization , ado.net Win Form and Asp.net using any modern Tools	P3	PLO5
2	Display the spirit of self-reliance to complete the lab journal timely and professionally.	A5	PLO9
3	Respond effectively w.r.t given scenarios related to implementation of different custom controls, delegates, serialization, ado.net Win Form and Asp.net Concepts.	P2	PLO5
4	Design & implement custom controls, delegates, serialization, ado.net Win Form and Asp.net based solution for solving a real-life complex problem or that can be used as a service in a real-world environment.	P4	PLO 3
5	Display project management skills and objective based approach to develop custom controls, delegates, serialization, ado.net Win Form and Asp.net based solutions in a teamwork environment.	A5	PLO 11

Course Title: Advanced Database Management Systems
Course Code: SEN 326
Prerequisite: CSC 220
Credit Hours: 2
Contact Hours: 2

Course Content: This course covers the advanced concepts and techniques of database management systems. The main topics cover including normalization and de-normalization, de-normalization techniques, issues of de-normalization, ORDBMS (Object-oriented relational database management systems), map method, order method, varying arrays, nested arrays, large objects, REF and DEREF operators, Oracle object-oriented objects, distributed databases, homogeneous and heterogeneous databases, spatial databases, spatial query language, netsted queries, sharding, NoSQL databases, MongoDB basics, MongoDB modeling data and aggregating data, XML DB, Xquery, transaction patterns, types of locks, concurrency control, and deadlocks.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Describe the fundamental concepts of object-relational management systems, de-normalization, spatial and distributed databases, concurrency and NoSQL	C1	PLO1
2	Explain the working mechanism of denormalization, object-relational database management system, NoSQL, spatial and distributed databases	C2	PLO1
3	Apply advanced databases concepts to solve problems of a particular domain	C3	PLO2
4	Construct simple and complex queries of ORDBMS, spatial and NoSQL databases	C5	PLO3
5	Present an advanced topic of databases with confidently and professionally	A2	PLO9

Recommended Books:
Text Book(s):

- Li, Y.(2010).Advanced Database Query Systems: Techniques, Applications and Technologies, Information Science Reference .McGraw-Hill Education
- Ishikawa, H.(2012).Object-Oriented Database System: Design and Implementation for Advanced Applications (2nd Edition) .O'Reilly Media
- Silberschatz, A.(2015).Database System Concepts (3rd Edition,) .Apress

Reference Book(s):

- Chodorow, K.(2011).MongoDB: The Definitive Guide: Powerful and Scalable Data Storage (2nd Edition,) .Morgan Kaufmann
- Hows, D., Membrey, P., Plugge, E., & Hawkins, T..(2012).The definitive guide to MongoDB: A complete guide to dealing with Big data using MongoDB (3rd Edition) .The MIT Press

Course Title: Advanced Database Management System Lab
Course Code: SEL 326
Prerequisite: CSL 220
Credit Hours: 1
Contact Hours: 3

Course Content: Advanced Database Lab will cover following content Normalization and De-normalization of SQL database, ORDBMS –CRUD Operation ,ORDBMS –Method Calling and Map Methods ,ORDBMS – Collections (VArray and Nested arrays) ,ORDBMS- Date time and Package ,ORDBMS- Object Table ,Oracle Objects Oriented- Basic components of Oracle objects, Oracle Objects Oriented - Applying object model to inherited data ,Spatial database – Simple queries, MONGO DB-CRUD operations, MONGO DB- Mastering find, MONGO DB – Modelling data and aggregating data, XML – Parser and Xquery

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Follow the instructions to implement oracle, SQL and Mongodb concepts using different Modern tool.	P3	PLO5
2	Display the spirit of self-reliance to complete the lab journal timely and professionally.	A5	PLO9
3	Respond effectively w.r.t given scenerios related to implementation of oracle, Mongodb, spatial database and XML Concepts	P2	PLO5
4	Design & implement Advanced Database Management System based solution for solving a real-life complex problem or that can be used as a service in a real-world environment.	P4	PLO 3
5	Display project management skills and objective based approach to develop oracle, Mongodb, spatial database and XML based solutions in a teamwork environment.	A5	PLO 11

Course Title: Semantic Web
Course Code: SEN 421
Prerequisite: SEN 310
Credit Hours: 3
Contact Hours: 3

Course Content: The course mainly covers the topics related to semantic web technologies. The topics including keyword based search engines limitations, semantic web, RDF, RDFS, Ontologies, kinds of ontologies, layered approach, RDF/XML, N-Triples, Turtle format, Protégé, Pizza ontology example, reasoning in protégé, OWL, types of OWL, RDF versus OWL, DL-Query in Protégé, RDF as Tell-and-Ask system, SPARQL query language, construct basic SPARQL queries, advanced SPARQL queries, sub-queries, semantic web application architecture, JENA and OWL APIs, programming examples, logic and inference, description logic, horn logic, monotonic rules, non-monotonic rules, semantic web rule language, rule mark-up language.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Describe the fundamental concepts of semantic web	C1	PLO1
2	Apply semantic web concepts in a particular domain	C3	PLO2
3	Construct SPARQL queries and ontology of a particular domain	C3	PLO3
4	Develop ontology-based application of a particular domain using Protégé	C3	PLO3

Recommended Books:

Text Book(s):

- Allemang, D. & Hendler, J..(2013).Semantic Web for the Working Ontologist .IGI Global

Reference Book(s):

- Antoniou, G. Groth, P., van Harmelen, F., & Hoekstra, R.(2013).A Semantic Web Primer . O'Reilly Media
- De Pablos, Ordonez.(2015).Advancing Information Management through Semantic Web Concepts and Ontologies .MIT Press
- Duchame, B.(2013).Learning SPARQL: Querying and Updating With SPARQL 1.1 .IGI Global
- Arp, R., Smith, B., Spear, A.D..(2011).Building Ontologies With Basic Formal Ontology (2nd Edition,) . Morgan Kaufmann
- Sheth, A.(2012).Semantic Web Ontology and Knowledge Based Enabled Tools, Services and Applications (3rd Edition) .The MIT Press
- Allemang, D. & Hendler, J..(2013).Semantic Web for the Working Ontologist .IGI Global

- Antoniou, G. Groth, P., van Harmelen, F., & Hoekstra, R.(2013).A Semantic Web Primer . O'Reilly Media
- De Pablos, Ordonez.(2015).Advancing Information Management through Semantic Web Concepts and Ontologies .MIT Press
- Duchame, B.(2013).Learning SPARQL: Querying and Updating With SPARQL 1.1 .IGI Global
- Arp, R., Smith, B., Spear, A.D..(2011).Building Ontologies With Basic Formal Ontology (2nd Edition,) .The MIT Press
- Sheth, A.(2010).Semantic Web Ontology and Knowledge Based Enabled Tools, Services and Applications .Sharpe, M. E. Inc.

Course Title: Semantic Web Lab
Course Code: SEL 421
Prerequisite: CSL 310
Credit Hours: 1
Contact Hours: 3

Course Content: The aim of this course is to teach the students the concepts, technologies and techniques underlying and making up the Semantic Web

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Practice different task related to creation of Semantic web using Resource Description Framework (RDF), Web Ontology Language (OWL) and SPARQL.	P3	PLO5
2	Show project management skills while developing Game Application project	A5	PLO11
3	Construct small scale project using any concepts of Semantic Web.	P4	PLO3
4	Show the professional commitment towards submission of Lab Journal, Project Report and Presentation	A5	PLO 9
5	Explain different concepts of Resource Description Framework (RDF), Web Ontology Language (OWL) and SPARQL for creation of semantic web in your own words.	P2	PLO 5

Course Title: Knowledge Based Management Systems
Course Code: SEN 455
Prerequisite: None
Credit Hours: 3
Contact Hours: 3

Course Content: The course covers the topics related to knowledge based management systems. The main topics including difference between data, information and knowledge, procedural and declarative knowledge, tacit and explicit knowledge, knowledge management life cycle, the Meyer & Zack life cycle, Bukowitz and William life cycle, integrated life cycle, SECI model, Choo-sense making model, knowledge management models, knowledge capturing, on-site observation, brainstorm, concept mapping, black boarding, consensus decision making, nominal group technique, delphi method, repertory grid, knowledge codification, knowledge mapping, decision table, decision tree, case-based reasoning, data mining and knowledge discovery, personal knowledge management, groupware, specific types of knowledge sharing, ontologies, supervised and unsupervised learning, knowledge management testing, logical and user acceptance testing, knowledge management system development.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Describe the fundamental concepts of knowledge-based management systems	C1	PLO1
2	Apply knowledge management concepts in a particular domain	C3	PLO2
3	Evaluate the impact of knowledge management practices in an organization	C6	PLO6

Recommended Books:

Text Book(s):

- Dalkir, K..(2013).Knowledge Management in Theory and Practice (3rd Edition) .Oxford University Press

Reference Book(s):

- Becerra-Fernandez, I., & Sabherwal, R..Knowledge Management Systems and processes. M.E.Sharpe Inc. (2nd Edition) .McGraw-Hill Education
- Hislop, D..(2016).Knowledge Management in Organizations: A Critical Introduction. (3rd Edition ,) .McGraw-Hill Education

Course Title: Information System Audit
Course Code: SEN 453
Prerequisite: None
Credit Hours: 3
Contact Hours: 3

Course Content: Introduction to Auditing, IS Audit charter, Polices, Procedures, The Audit Process, Audit computer networks and communication, Auditing software development, Acquisition, Maintenance, Auditing IT infrastructure, Auditing Management and Organization, Business process re-engineering: IS audit proposal, report, evidence and follow-up, complaint to standard, Enterprise service agreement, IP pro count policies and process, Backup and procedures, Overview of Computer-Assisted Audit Tools and Techniques.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Describe the concepts and standards related to the discipline of Information System Audit.	C1	PLO1
2	Analyze and Audit Information Systems	C4	PLO2

Recommended Books:

Text Book(s):

- Chris Davis and Mike Schiller.(2015).IT Auditing Using Controls to Protect Information Assets .Wrox

Reference Book(s):

- Peter Gregory.(2017).CISA® Certified Information Systems Auditor All-in-One Exam Guide (7th Edition,) .Create Space Independent Publishing Platform

Course Title: Software Applications for Mobile Devices
Course Code: SEN 448
Prerequisite: SEN 210
Credit Hours: 2
Contact Hours: 2

Course Content: Introduction to mobile devices and their platforms: constraints, emerging technologies and their performance/power trade-offs, factors in developing mobile applications, introduction to mobile computing, introduction to Android & its features, Android architecture, historical background, versions & API levels. Development environments, Android debug bridge (ADB), real / virtual device attachment through adb. Android project & its structure, getting events from device via logcat. Application components, Android manifest file. Components of a screen, creating the user interface, views, utilizing the action bar and menus. Activity and its lifecycle intents and its types. passing and receiving data from other components through intents. Multi-programming: services, broadcast receivers, threads and handlers, synchronous & asynchronous tasks, inter thread communication. Task and back stack, managing tasks, launch modes of an activity. Permissions: evaluate, declare, and restricting requesting permissions. Working on Google developer console. Location-aware applications, working with Google maps. Web services: accessing and creating. Notifications, sending/receiving SMS messages, getting feedback; sending email. Persisting data, sharing data, utilizing firebase, connecting to database servers.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Memorize and define basic concepts and techniques of developing applications for the mobile devices.	C1	PLO1
2	Explain the design, solution and architecture of underlying mobile application.	C2	PLO1
3	Apply knowledge and understanding to solve complex mobile application problems having specific requirements while transferring real-life mobile application related problems into productive solution.	C3	PLO3
4	Analyze programs with respect to their performance, correctness, possible output, errors and exceptions.	C4	PLO2

Course Title: Software Application for Mobile Devices Lab
Course Code: SEL 448
Prerequisite: SEL 210
Credit Hours: 1
Contact Hours: 3

Course Content: Handheld systems, such as smartphones and tablets are now the most common way for people to access and interact with computing services. The demand for application development skills is therefore growing at a breathtaking pace. These skills, however, are multi- faceted, requiring students to master computer science and engineering principles, to learn the details of specific mobile application platforms, and to design artistic and engaging user interfaces that respond to how, where and why handheld applications are used.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Practice different task related to Mobile Application Development.	P3	PLO5
2	Show project management skills while developing Mobile Application project	A5	PLO11
3	Construct small scale project using any concepts of mobile app development.	P4	PLO3
4	Show the professional commitment towards submission of Lab Journal, Project Report and Presentation	A5	PLO 9
5	Explain different concepts of Mobile Application Development in your own words.	P2	PLO 5

Course Title: Principles of Programming Languages
Course Code: CSC 445
Prerequisite: CSC 113
Credit Hours: 3
Contact Hours: 3

Course Content: Introduction: Models of Computation, Syntax and Semantics, Pragmatics, Language Design Principles. Syntax and Semantics: Context-Free Grammars, Regular Expressions, Attribute Grammars and Static Semantics, Algebraic Semantics, Axiomatic Semantics, Denotational Semantics. BNF grammars and Syntax, Operational Equivalence, Abstraction and Generalization, Expressions, Assignment Statement, and Control Structures, Functional Programming: The Lambda Calculus, Operational Semantics, Reduction Order, Recursive Functions, Logic Programming, Inference Engine, Concurrency

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Describe the underlying theory of programming languages	C1	PLO1
2	Analyze programming languages to choose appropriate language for a Project	C4	PLO2
3	Explain the formal semantics design of a programming Languages	C2	PLO2

Recommended Books:

Text Book(s):

- Mike Grant ,Zachary Palmer, Scott Smith, John Hopkins.(2006).Principles of Programming Languages (2nd Edition, .). Morgan Kaufmann

Reference Book(s):

- Robert W. Sebesta.(2008).Concepts of Programming Languages (1st Edition,) .A K Peters/CRC Press
- Scott, Michael L.(2008).Programming Language Pragmatics .Lone Eagle

Course Title: Game Application Development
Course Code: SEN 421
Prerequisite: CSC 210
Credit Hours: 2
Contact Hours: 2

Course Content: Introduction to game development and game development careers. The purpose of this course is to provide students with the foundation in game design and development necessary for use in the workforce or for further study in the field of game development and creation. Includes examination of history and philosophy of games, the game production process, employee factors for success in the field, and current issues and practices in the game development industry.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Apply techniques and methods in the production of a diverse portfolio of industry-standard game-art animation assets, game prototypes ad documents	C3	PLO3
2	Create compelling game content for multiple gaming applications, including triple-A, serious, casual and mobile games, utilizing industry-standard tools and software	C3	PLO3
3	Implement game assets to execute the production of a game within a team setting	C4	PLO3

Recommended Books:

Text Book(s):

- Jesse Schell.(1998).The Art of Game Design: A Book of Lenses (2nd Edition) .CRC Press

Reference Book(s):

- Flint Dille, John Zuur Platten .(2002).The Ultimate Guide to Video Game Writing and Design (2nd Edition,) .Addison-Wesley Professional

Course Title: Game Application Development lab
Course Code: SEL 328
Prerequisite: CSL 210
Credit Hours: 1
Contact Hours: 3

Course Content: This Course gives History of Computer and Video Games, Game Design Principles, Python Programming, Pygame, Storytelling, Sprites and Animation. Contents include Game Development Methodologies, Physics, Loose Ends, Audio, Sound, and Music (PDF), 2D Game Group Project Check-In, Game Testing, Ethics, MMORPGs, and Securing Online Games, Game Engines, iOS Development, Cocos2D, Games in 2012 and Beyond.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Practice different task related to Game Development.	P3	PLO5
2	Show project management skills while developing Game Application project	A5	PLO11
3	Construct small scale project using any concepts of Game app development.	P4	PLO3
4	Show the professional commitment towards submission of Lab Journal, Project Report and Presentation	A5	PLO 9
5	Explain different concepts of Game Application Development in your own words.	P2	PLO 5

Course Title: Software Metrics & Estimation
Course Code: SEN 324
Prerequisite: None
Credit Hours: 3
Contact Hours: 3

Course Content: Overview of software metrics; Basics of measurements; Goal-based framework for software measurement; Software measure classification; Empirical investigation, principles and techniques; Formal experiments: Planning, principles, types and selection; Measuring internal product attributes: size and structure; Measuring cost and effort; Measuring external product attributes: quality and reliability; Software test metrics; Object-oriented metrics Measurement management

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Describe how quantitative and empirical methods are applied to software engineering problems	C1	PLO1
2	Explain the fundamentals of measurement, experimentation, data collection and analysis	C2	PLO1
3	Critically evaluate and discuss different software matrices of different applications in the real world with course participants and learners	C4	PLO4
4	Have a working knowledge of software size measurement (Function Point counting, etc.)	C1	PLO1

Recommended Books:

Text Book(s):

N.E. Fenton and S.L. Pfleeger.(2005).Software Metrics: A Rigorous and Practical Approach .RAND Corporation

Reference Book(s):

Stephen H. Kan.(2012).Metrics and Models in Software Quality Engineering.Springer

Course Title: Mathematical Tools for Software Engineering
Course Code: SEN 441
Prerequisite: CSC 113
Credit Hours: 3
Contact Hours: 3

Course Content: Describes the computation of mathematical functions in decimal arithmetic, including coverage of 256-bit floating-point formats. Describes implementation in the C programming language, and also provides interfaces to Ada, C#, C++, FORTRAN, Java, and Pascal. Pays extensive attention to little-understood aspects of floating-point and integer arithmetic, and to software portability, including to important historical architectures

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Define the underlying theory of Mathematical Tools for Software Engineering	C1	PLO1
2	Analyze different mathematical functions, By using them in Project	C4	PLO4
3	Describes implementation of mathematical functions in the C programming language	C2	PLO2

Recommended Books:

Text Book(s):

- Louis Baker.C Mathematical Function Handbook (Programming Tools for Engineers and Scientists) (1st Edition) .Addison-Wesley Professional

Reference Book(s):

- David B.Power Programming With Mathematica: The Kernel (Programming Tools for Scientists & Engineers) (1st Edition) .Addison-Wesley Professional

Course Title: Design Pattern
Course Code: SEN 450
Prerequisite: None
Credit Hours: 3
Contact Hours: 3

Course Content: This course extends object-oriented analysis and design by incorporating design patterns to create interactive applications. Through a survey of established design patterns, you will gain a foundation for more complex software applications. Finally, you will identify problematic software designs by referencing a catalog of code smells.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Explain how to use design patterns to address user interface design issues	C2	PLO1
2	Identify the most suitable design pattern to address a given application design problem	C4	PLO2
3	Apply design principles (e.g., open-closed, dependency inversion, least knowledge)	C5	PLO3

Recommended Books:

Text Book(s):

- Erich Gamma, Richard Helm, Ralph Johnson , John Vlissides .(2010).Design Patterns: Elements of Reusable Object-Oriented Software .Springer

Reference Book(s):

- Martin Fowler.(2010).Patterns of Enterprise Application Architecture (4th Edition) .Prentice Hall

Course Title: Agile Development
Course Code: SEN 452
Prerequisite: None
Credit Hours: 3
Contact Hours: 3

Course Content: Context, the Agile Manifesto, Agile Methods, Official Agile Principles, Agile Values, Principles, the enemy: Big Upfront Anything, organizational principles, technical principles, a few method-specific principles, Roles, traditional manager roles, the three Scrum roles, other Agile roles, Practices, meetings, development, release, testing, management, Artifacts, from user stories to burn down charts, assessment on Agile methods

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Describe the fundamental principles and practices associated with agile software development methods	C1	PLO1
2	Explain the working mechanism of agile software development methods	C2	PLO1
3	Apply the principles and practices of agile software development in a particular scenario	C3	PLO3
4	Analyze the current practices of agile software development methods in industry	C4	PLO2

Recommended Books:

Text Book(s):

- Torgeir Dingsoyr , Tore Dyba.(2008).Agile Software Development (1st Edition,).An e-book by peterpixel

Reference Book(s):

- Mike Cohn.(2010).Agile Estimating and Planning   (2nd Edition) .O'R

Course Title: Usability Engineering
Course Code: SEN 456
Prerequisite: SEN 320
Credit Hours: 3
Contact Hours: 3

Course Content: To help students gain a general understanding of the principles and concepts governing the functions of Usability Engineering. Usability engineering is a professional discipline that focuses on improving the usability of interactive systems. It draws on theories from computer science and psychology to define problems that occur during the use of such a system. Usability engineering involves the testing of designs at various stages of the development process, with users or with usability experts. Acquaint students with the usability testing approaches that makes design, implementation of the complex designing techniques possible and how to create flawless interfaces that are usable and error free.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Define the basics of Usability Engineering	C1	PLO1
2	Apply design rules.	C3	PLO2
3	Conduct Usability Testing and how to use usability heuristics in the usability engineering lifecycle.	C4	PLO2

Recommended Books:

Text Book(s):

- Peter Contradie.(2013).Introduction To Good Usability (1st Edition) .Basic Books;
- Livro.(2017).Designing Interfaces (1st Edition,) .e-book by UXPin
- Don Norman.(2017).The Design Of Everyday Things (1st Edition,) .e-book by UXPin.

Reference Book(s):

- Chris Bank ,Jerry Cao.(2004).The Guide To Usability Testing .Pearson
- Chris Bank And Jerry Cao.(2010).The Guide To Ux Design Process & Documentation (3rd Edition,) .Pearson

Course Title: Introduction to Soft Computing
Course Code: SEN 443
Prerequisite: None
Credit Hours: 2
Contact Hours: 2

Course Content: Introduction to Soft Computing, Fuzzy Sets Theory, Fuzzy Logic, Artificial Neural Networks, Probabilistic Reasoning, Genetic Algorithms, Neuro-Fuzzy Technology, Combination of Genetic Algorithms with Neural Networks, Combination of Genetic Algorithms and Fuzzy Logic, Applications of Soft Computing (three to four real life applications).

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Describe the basic areas of Soft Computing including Artificial Neural Networks, Fuzzy Logic and Genetic Algorithms	C1	PLO1
2	Explain the mathematical background for carrying out the optimization associated with neural network learning	C1	PLO1
3	Analyze different Genetic Algorithms and Combination of Genetic Algorithms with other algorithms	C4	PLO2

Recommended Books:

Text Book(s):

- J.S.R.Jang, C.T.Sun and E.Mizutani.(2008).Neuro-Fuzzy and Soft Computing (2nd Edition,) .Prentice Hall

Reference Book(s):

- Simon O. Haykin.(1999).Neural Network and Learning Machine (1st Edition) .The MIT Press

Course Title: Introduction to Soft Computing Lab
Course Code: SEL 443
Prerequisite: None
Credit Hours: 1
Contact Hours: 3

Course Content: This course intended Understanding soft computing techniques and their role in problem solving. Conceptualize and parameterize various problems to be solved through basic soft computing techniques. Analyze and integrate various soft computing techniques in order to solve problems effectively and efficiently.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Practice the implementation guidelines related to various neural network architectures, perceptrons and counter propagation networks, fuzzy systems, genetic algorithms and their applications	P3	PLO5
2	Show project management skills while developing Soft Computing project	A5	PLO11
3	Construct small scale project using any concepts of Soft Computing.	P4	PLO3
4	Show the professional commitment towards submission of Lab Journal, Project Report and Presentation	A5	PLO 9
5	Explain different concepts of Soft Computing in your own words.	P2	PLO 5

Course Title: Natural Language Processing
Course Code: CSC 441
Prerequisite: GSC 122
Credit Hours: 3
Contact Hours: 3

Course Content: Logistics, Goals of the Field Of NLP. The Hidden Structure Of Language, Why NLP Is Difficult: Newspaper Headlines, Machine Translation, Machine Translation History, Centauri/Arcturan Example Questions That Linguistics Should Answerers Machine Translation (MT) Valuation, Sparsity, Smoothing

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Describe the core NLP concepts	C1	PLO1
2	Explain the various Natural language processing systems	C2	PLO1
3	Apply existing natural language processing techniques to conduct basic natural language processing, such as text normalization, named entity extraction, or syntactic parsing.	C3	PLO2
4	Design NLP system and write algorithms for it.	C6	PLO3

Recommended Books:

Text Book(s):

- Daniel Jurafsky and James H Martin.(2014).Speech and Language Processing (2nd Edition) .Cambridge University Press

Reference Book(s):

- Chris Manning and Hinrich Schuetze.(2012).Foundations of Statistical Natural Language Processing .Oxford University Press

Course Title: Scientific Computing
Course Code: SEN 331
Prerequisite: None
Credit Hours: 3
Contact Hours: 3

Course Content: Numerical methods for mathematical, computational, physical sciences and engineering: error analysis, floating-point arithmetic, nonlinear equations, numerical solution of systems of algebraic equations, banded matrices, least squares, unconstrained optimization, polynomial interpolation, numerical differentiation and integration, numerical solution of ordinary differential equations, truncation error, numerical stability for time dependent problems and stiffness.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Understanding of the basic Numerical methods for mathematical, computational, physical sciences and engineering: error analysis, floating-point arithmetic, nonlinear equations	C1	PLO1
2	Develop the ability to implement the most common numerical algorithms for solving a wide range of problems	C4	PLO3

Recommended Books:

Text Book(s):

- José Luis Bermúdez.(2000).Cognitive Science: An Introduction to the Science of the Mind (1st Edition) .The MIT Press

Reference Book(s):

- Robert Snowden and Peter Thompson.(1998).Basic Vision: An Introduction to Visual Perception .Springer

Course Title: Agent Based Computing
Course Code: SEN 330
Prerequisite: None
Credit Hours: 3
Contact Hours: 3

Course Content: The course begins with an overview of the agent systems and software agents. Then we focus on agent system architecture and infrastructure from a software engineering viewpoint, including:

1. Requirements for agent-based systems
2. Modeling and design of agent-based systems
3. Development process for agent-based systems

Topics such as agent architecture, communication, and knowledge sharing, computing and uncertainty management are discussed. Studying society of agents and models of agency follows. Finally, a perspective on a methodology for agent-oriented software engineering and standards are presented.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Describe concepts of single agent systems and multi agent systems.	C1	PLO1
2	Compare architecture of single agent and multiagent systems, compare agent communication languages and negotiation, cooperative and competitive behavior in multiagent system	C2	PLO1
3	Develop a Software agent	C5	PLO3

Recommended Books:

Text Book(s):

- Gerhard Weiss.(2005).Multiagent Systems : A Modern Approach to Distributed Artificial Intelligence (4th Edition) .McGraw-Hill Professional

Reference Book(s):

- M.N. Huhns and M.P. Singh..System Analysis & Design using UML (1st Edition) .CRC Press;

Course Title: Mobile and Pervasive Computing
Course Code: SEN 459
Prerequisite: None
Credit Hours: 3
Contact Hours: 3

Course Content: This course introduces the concepts in the area of mobile computing, to provide a computer systems perspective on the converging areas of wireless networking, embedded systems, and software. It focuses on pervasive computing, vision, mobile device architectures, operating systems, applications and platforms, mobile application design and development. Moreover, it emphasizes on wireless networking technologies, pervasive naming and discovery, location detection and tracking, pervasive data access, context awareness, security in mobile and pervasive systems, human interaction in mobile and pervasive systems and energy management.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Describe the fundamental concepts in the area of pervasive computing such as smart spaces, Invisibility, Localized spaces, and uneven onditions	C1	PLO1
2	Realize the key areas of mobile computing, including mobile networking, Mobile information access, Adaptive Applications, Energy-Aware systems, Location Sensitivity	C2	PLO2
3	Learn about ARM processors and their instruction set architectures, processors: XScale, ARM11, i.MX, bus and memory architectures, I/O architectures, SOC designs	C3	PLO3

Recommended Books:

Text Book(s):

- Adelstein Frank Et.Al.(2018).Fundamentals of Mobile and Pervasive Computing . Independently published

Reference Book(s):

- Minyi Guo, Jingyu Zhou, Feilong Tang, Yao Shen.(2018).Pervasive Computing: Concepts, Technologies and Applications .ZAZAD Solutions Inc

Course Title: Distributed Computing
Course Code: CSC 456
Prerequisite: CSC 210
Credit Hours: 2
Contact Hours: 2

Course Content: Asynchronous/synchronous computation/communication, concurrency control, fault tolerance, GPU architecture and programming, heterogeneity, interconnection topologies, load balancing, memory consistency model, memory hierarchies, Message passing interface (MPI), MIMD/SIMD, multithreaded programming, parallel algorithms & architectures, parallel I/O, performance analysis and tuning, power, programming models (data parallel, task parallel, process-centric, shared/distributed memory), scalability and performance studies, scheduling, storage systems, synchronization, and tools (Cuda, Swift, Globus, Condor, Amazon AWS, OpenStack, Cilk, gdb, threads, MPICH, OpenMP, Hadoop, FUSE).

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Define the basics of parallel and distributed computers	C1	PLO1
2	Write portable programs for parallel or distributed architectures using Message-Passing Interface (MPI) library	C3	PLO2
3	Analytical modelling and performance of parallel programs	C4	PLO3

Recommended Books:

Text Book(s):

- A.S. Tanenbaum and M. V. Steen.(2015).Distributed Systems: Principles and Paradigms .Packt Publishing

Reference Book(s):

- K Hwang, J Dongarra and GC. C. Fox.(2018).Distributed and Cloud Computing: Clusters, Grids, Clouds, and the Future Internet .Packt Publishing

Course Title: Distributed Computing Lab
Course Code: CSL 456
Prerequisite: CSL 210
Credit Hours: 1
Contact Hours: 3

Course Content: Asynchronous/synchronous computation/communication, concurrency control, fault tolerance, GPU architecture and programming, heterogeneity, interconnection topologies, load balancing, memory consistency model, memory hierarchies, Message passing interface (MPI), MIMD/SIMD, multithreaded programming, parallel algorithms & architectures, parallel I/O, performance analysis and tuning, power, programming models (data parallel, task parallel, process-centric, shared/distributed memory), scalability and performance studies, scheduling, storage systems, synchronization, and tools (Cuda, Swift, Globus, Condor, Amazon AWS, OpenStack, Cilk, gdb, threads, MPICH, OpenMP, Hadoop, FUSE).

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Give an explanation related to concepts of Distributed Computing.	P3	PLO5
2	Show the professional commitment towards submission of lab files and project reports.	A5	PLO11
3	Perform the task related to Distributed Computing.	P4	PLO3
4	Adapt the skills to perform the task related to Distributed Computing concepts and techniques	A5	PLO8
5	Design different system using MPI Libraries for specific requirement.	P2	PLO5

Course Title: Object Oriented Software Engineering
Course Code: SEN 335
Prerequisite: SEN 210
Credit Hours: 3
Contact Hours: 3

Course Content: On completion of this course students will be able to understand how software developers, programmers and managers meet the challenges and resolve the software crisis. Examine the activities of a developer when joining a project organization and its communication infrastructure. Describing activities that transform the use cases and scenarios produced during requirements elicitation into analysis model.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Define and explain basic concepts of object-oriented software engineering	C1	PLO1
2	Analyze problems, develop abstraction describing a system that solve those problems	C2	PLO2
3	Design projects requiring the implementation of concepts studied in class	C1	PLO2

Recommended Books:

Text Book(s):

- Bernd Bruegge And Allen H. Dutoit..(2013).Object Oriented Software Engineering Using Uml, Patterns and Java (3rd Edition) .Wiley

Reference Book(s):

- Timothy C. Lethbridge & Robert Laganiere.(1997).Object-Oriented Software Engineering: Practical Software Development Using UML And Java (1st Edition) .Prentice Hall

Course Title: Object Oriented Software Engineering Lab
Course Code: SEL 335
Prerequisite: SEL 210
Credit Hours: 1
Contact Hours: 3

Course Content: Object-Oriented Software Engineering is an approach/paradigm of developing software by identifying and implementing a set of objects and their interactions to meet the desired objectives. The first step towards this kind of software development is to learn and master the various concepts, tools and techniques that are to be used design and implementation of such systems.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	**Follow** the instructions to implement the concepts of Object-oriented paradigm in Labs when applicable.	P3	PLO 5
2	**Display** project management plan and tabulate appropriate testing plans at different levels during the development of the software.	A5	PLO 11
3	**Design** and build the specification and identify the components to build the architecture for a given problem, all using an appropriate software engineering Methodology.	P4	PLO 5
4	**Display** the spirit of resourcefulness for completing the lab journal timely and professionally.	A5	PLO 9
5	**Show** the ability to perform and provide response on the understanding of object-oriented design artifacts and their mapping to object-oriented paradigms.	P2	PLO 5

Course Title: Data Warehousing
Course Code: CSC 454
Prerequisite: CSC 220
Credit Hours: 3
Contact Hours: 3

Course Content: This course provides an introduction to data warehouse design. Data modeling, database design and database access are reviewed. Issues in data warehouse planning, design, implementation, and administration are discussed in a seminar format.   The role of data warehouse in supporting Decision Support Systems (DSS) is also reviewed.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Evaluate an organization for data warehouse maturity and business architecture alignment	C2	PLO1
2	Create data integration workflows using prominent open source software	C3	PLO2
3	Perform operations on pivot tables to satisfy typical business analysis requests using prominent open source software	C4	PLO3

Recommended Books:

Text Book(s):

- Ralph Kimball.The Data Warehouse Toolkit (First Edition) .O'Reilly Media

Reference Book(s):

- Paul Gray, Hugh J. Watson..Decision Support in the Data Warehouse (First Edition) .O'Reilly Media

Course Title: Introduction to Data Sciences
Course Code: CSC 495
Prerequisite: CSC 220
Credit Hours: 2
Contact Hours: 2

Course Content: Introduction to Data Science, Data Science Life cycle & Process (Asking Right Questions, Obtaining Data, Understanding Data, Building Predictive Models, Generating Visualizations) For Building Data Products, Introduction to Data (Types of Data and Datasets), Data Quality (Measurement and Data Collection Issues), Data pre-processing Stages (Aggregation, Sampling, Dimensionality Reduction, Feature subset selection, Feature creation etc.), Algebraic & Probabilistic View of Data, Introduction to Python Data Science Stack (Python, Numpy, Pandas, Matplotlib), Relational Algebra & SQL, Scraping & Data Wrangling (assessing, structuring, cleaning & munging of data), Basic Descriptive & Exploratory Data Analysis, Introduction to Text Analysis (Stemming, Lemmatization, Bag of Words, TF-IDF), Introduction to Prediction and Inference (Supervised & Unsupervised) Algorithms, Introduction to Scikit Learn, Bias-Variance Tradeoff, Model Evaluation & Performance Metrics (Accuracy, Contingency Matrix, Precision-Recall, F-1 Score, Lift, etc.), Introduction to Map-Reduce paradigm

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Explain Data Science Life cycle & Process (Asking Right Questions, Obtaining Data, Understanding Data, Building Predictive Models, Generating Visualizations)	C1	PLO1
2	Compare and Contrast Performance Metrics (Accuracy, Contingency Matrix, Precision-Recall, F-1 Score, Lift, etc.),	C2	PLO1
3	Present Different data science research	A2	PLO10

Recommended Books:

Text Book(s):

- William McKinney.(2011).Python for Data Analysis (2nd Edition) .Cambridge University Press

Reference Book(s):

- Joel Grus.(2001).Data Science from Scratch (Volume 1 & 2) .Wiley

Course Title: Introduction to Data Sciences Lab
Course Code: CSL 495
Prerequisite: CSL 220
Credit Hours: 1
Contact Hours: 3

Course Content: Introduction to Data Science, Data Science Life cycle & Process (Asking Right Questions, Obtaining Data, Understanding Data, Building Predictive Models, Generating Visualizations) For Building Data Products, Introduction to Data (Types of Data and Datasets), Data Quality (Measurement and Data Collection Issues), Data pre-processing Stages (Aggregation, Sampling, Dimensionality Reduction, Feature subset selection, Feature creation etc.), Algebraic & Probabilistic View of Data, Introduction to Python Data Science Stack (Python, Numpy, Pandas, Matplotlib), Relational Algebra & SQL, Scraping & Data Wrangling (assessing, structuring, cleaning & munging of data), Basic Descriptive & Exploratory Data Analysis, Introduction to Text Analysis (Stemming, Lemmatization, Bag of Words, TF-IDF), Introduction to Prediction and Inference (Supervised & Unsupervised) Algorithms, Introduction to Scikit Learn, Bias-Variance Tradeoff, Model Evaluation & Performance Metrics (Accuracy, Contingency Matrix, Precision-Recall, F-1 Score, Lift, etc.), Introduction to Map-Reduce paradigm

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Give an explanation related to concepts of Data Sciences.	P3	PLO5
2	Show the professional commitment towards submission of lab files and project reports.	A5	PLO11
3	Perform the task related to Data Science.	P4	PLO3
4	Adapt the skills to perform the task related to Data science	A5	PLO8
5	Design Applications for Data Sciences specific requirement.	P2	PLO5

Course Title: Big Data Analytics
Course Code: SEN 332
Prerequisite: None
Credit Hours: 3
Contact Hours: 3

Course Content: This course discusses techniques for storing and processing large amounts of structured/ unstructured data using Big Data Platforms. It also discusses opportunities, challenges, importance and application of Big Data. It also discusses analytics tools and techniques deployed on Big Data to get valuable insights and presenting those insights in wholesome manner.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Describe the fundamental information to get insight into the challenges/ opportunities with big data	C1	PLO1
2	Explain the techniques for storing and processing large amounts of structured and unstructured data using Big Data Platforms	C2	PLO1
3	Apply big data concepts to get valuable information on market trends	C3	PLO2

Recommended Books:

Text Book(s):

- Jure Leskovec, Anand Rajaraman, Jeff Ullman.(2009).Mining of Massive Datasets (4th Edition,) . O'Reilly Media
- James Silverton .(2013).Data Model Resource Book (13th Edition) .Pearson

Reference Book(s):

- Tom White.(2014).Hadoop: The Definitive Guide (11th Edition) .Pearson

Course Title: Management Information Systems
Course Code: CSC 458
Prerequisite: SEN 120
Credit Hours: 3
Contact Hours: 3

Course Content: This course provides an overview of information systems in today's organizations. It is designed to familiarize students with the technical foundation for understanding information systems, the role of information systems in enhancing business processes and management decision making across the enterprise, and the process of building and managing systems in organizations. The topic includes strategic business objectives of information systems, perspectives on information systems, contemporary issues of information systems, types of information systems, systems for collaboration and social business, impact of information systems on business firms, understand ethical and social issues related to systems, the database approach, managing data resources, communication networks, business value of security and control, enterprise systems, supply chain management systems, e-commerce and internet, knowledge work systems, decision making and information systems, case studies.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Describe the fundamental concepts of management information systems	C1	PLO1
2	Analyze how information system impacts a business	C4	PLO2
3	Design information system of a particular domain	C5	PLO3

Recommended Books:

Text Book(s):

- Laudon, K.C. Laudon, J.P.(2012).Management Information Systems: Managing the digital firm . IGI Global

Reference Book(s):

- Laudon, K.C. & Laudon, J.P.(2001).Essentials of MIS . Pennwell Books
- Adamantios Koumpis.(2006).Management Information Systems for Enterprise Applications:Business Issues , Research and Solutions (1st Edition,) .Springer

Course Title: Distributed Database Systems
Course Code: SEN 327
Prerequisite: None
Credit Hours: 3
Contact Hours: 3

Course Content: Introduction to Databases and Distributed Database Systems, Background (Relational Data Model, Computer Networks), Distributed Database Architectures, Distributed Database Design, Horizontal Fragmentation, Vertical Fragmentation, Replication, Introduction to Transaction Management, Distributed Concurrency Control, Introduction to Query Processing, Query Processing in Distributed Databases, Query Optimization, Introduction to Parallel Processing, Parallel DBMSs Issues, Distributed Object Database Management Systems, Database Interoperability.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Define the basics of Distributed Database Systems	C1	PLO1
2	Explain and compare Query Processing, Query Processing in Distributed Databases and Query Optimization,	C2	PLO1
3	Present different Distributed Database Systems topic Confidently and professionally	A2	PLO9

Recommended Books:

Text Book(s):

- Ann Chambers .(2010).Distributed Generation: A Basic Guide (4th Edition,) . Prentice Hall Press

Reference Book(s):

- Alakananda Bhattacharya and Amit Konar.(2013).Parallel and Distributed Logic Programming: Towards the Design of a Framework for the Next Generation Database Machines (3rd Edition) .Addison-Wesley Professional

Course Title: Distributed Database Systems
Course Code: SEL 327
Prerequisite: None
Credit Hours: 1
Contact Hours: 3

Course Content: This course will deal with), Distributed Database Architectures, Distributed Database Design, Horizontal Fragmentation and computer networks.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Give an explanation related to concepts of Distributed Database Systems	P3	PLO5
2	Show the professional commitment towards submission of lab files and project reports.	A5	PLO11
3	Perform the task related to Distributed Database Systems.	P4	PLO3
4	Adapt the skills to perform the task related to Distributed Database Systems concepts and techniques	A5	PLO8
5	Design different system using Distributed Database Systems for specific requirement.	P2	PLO5

Course Title: Computer Graphics
Course Code: CSC 444
Prerequisite: None
Credit Hours: 2
Contact Hours: 2

Course Content: This course is designed to provide a comprehensive introduction to computer graphics leading to the ability to understand contemporary terminology, issues, and trends. Topics cover geometric transformations, view port transformations, software systems (OpenGL), shading and mapping etc. Course material is structured to meet the needs of both designers and users of interactive computer graphics systems

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Describe the core concepts of computer graphics	C1	PLO1
2	Apply the mathematical foundation of the concepts of computer graphics.	C3	PLO2
3	Implement using OpenGl different graphics concepts.	C5	PLO3

Recommended Books:

Text Book(s):

- Pauline, Baker.(2012).Computer Graphics (3rd Edition) .Morgan Kaufmann

Reference Book(s):

- Foley, Van Dam and Hugs..Computer Graphics: Principles & Practice (2nd Edition) .Morgan Kaufmann

Course Title: Computer Graphics Lab
Course Code: CSL 444
Prerequisite: None
Credit Hours: 1
Contact Hours: 3

Course Content: The major objectives for this course are to learn to implement concepts of Computer Graphics that includes world coordinates, viewport, 2D and 3D transformations, Projections, 3D viewing, Illumination and shading, texture mapping, Line and circle drawing algorithms, color theory using Open GL Programming.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Practice the implementation guidelines related computer graphics algorithms in OpenGL.	P3	PLO5
2	Display project management skills in creating solutions for graphics projects in team environment.	A5	PLO11
3	Design & implement computer graphics projects according to the specific requirements.	P4	PLO3
4	Display the spirit of self-reliance to complete the lab journal timely and professionally.	A5	PLO8
5	Show the ability to act upon a sequence of setups pertaining to designing graphics in response to given scenarios.	P2	PLO5

Course Title: Digital Animation
Course Code: SEN 39
Prerequisite: None
Credit Hours: 3
Contact Hours: 3

Course Content: This course provides the essential knowledge of digital animation techniques, demonstrating the processes necessary to develop animation at a professional level, from creation to production. During the three-week course, students will learn the basics of digital animation. In the first week of the course we will be analyzed significant case study, which will allow to make it clear to students what techniques and software are used in various professional fields of digital animation? In the second and third week, students will realize the simple animations to be able to experiment with the use of software and better understand the notions received in the first week.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Define the process of creating a digital animation	C1	PLO1
2	Create a drawing using motion graphics techniques	C3	PLO3
3	Explain the principles of 2d and 3d animation	C2	PLO1

Recommended Books:

Text Book(s):

- Rick Parent.(2009).Computer Animation: Algorithms and Techniques. Cengage Learning

Reference Book(s):

- Ronn Brinkmann.(2008).The Art and Science of Digital Compositing: Techniques for Visual Effects, Animation and Motion Graphics .Jones & Bartlett Learning

Course Title: Multimedia Systems
Course Code: SEN 493
Prerequisite: None
Credit Hours: 3
Contact Hours: 3

Course Content: Digital video coding, Transcoding for universal media access, 3D and Multiview TV, High Dynamic Range Video, Quality of Experience for HDR and 3D, Scalable Video Coding, Content protection (watermarking), Design of multimedia middleware (e.g., multimedia authoring) and Standards such as MPEG-2, MPEG-4, H.264, MPEG-7, and MPEG-21

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Describe different realizations of multimedia tools and their usage.	C1	PLO1
2	Implement various multimedia standards and compression technologies	C3	PLO2
3	Analyze various Design of multimedia middleware (e.g., multimedia authoring) and Standards such as MPEG-2, MPEG-4, H.264, MPEG-7, and MPEG-21	C4	PLO1

Recommended Books:

Text Book(s):

- Parag Havaldar and Gerard Medioni.(2003).Multimedia Systems: Algorithms, Standards, and Industry Practices .GP

Reference Book(s):

- T. M. Savage and K.E. Vogel..An Introduction to Digital Multimedia (2nd Edition) .Pearson

Course Title: Digital Image Processing
Course Code: CEN 445
Prerequisite: None
Credit Hours: 2
Contact Hours: 2

Course Content: Introduction Digital Image Processing Computer Vision and Pattern Recognitions Field Usage of DIP, Fundamental steps in DIP Component. Digital Image Fundamentals. Element of visual Perception, Image Sensing and Acquisition Image Sampling and Quantization. Pixels operation, linear & non lineate operation. Image Enhancement in spatial Domain: Background, Grey level Transformation. Edge detection sharpening. Image Enhancing in Frequency Domain, background, Frequency domain, Faired Transform smarting, Sharpening, Homo-morphic filtering implementation. Image Restorations. A model of the Image Degradation/ Restoration Process, Noise Model, Restoration in the Presence of Noise-spatial filtering, Periodic Noise Reduction by frequency Domain filtering.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Define the core concepts of Digital Image Processing	C1	PLO1
2	Explain and compare Element of visual Perception, Image Sensing and Acquisition Image Sampling and Quantization	C2	PLO1
3	Present Digital Image processing topics confidently and professionally	A2	PLO10

Recommended Books:

Text Book(s):

- Gonzalez, Woods and Eddins.(2003).Digital Image Processing using Matlab.Pearson

Reference Book(s):

- RC Gonzalez and R.E Woods.(2011).Digital Image Processing .Springer

Course Title: Digital Image Processing Lab
Course Code: CEL 445
Prerequisite: GSL 121
Credit Hours: 1
Contact Hours: 3

Course Content: Introduction Digital Image Processing Computer Vision and Pattern Recognitions Field Usage of DIP, Fundamental steps in DIP Component. Digital Image Fundamentals. Element of visual Perception, Image Sensing and Acquisition Image Sampling and Quantization. Pixels operation, linear & non lineate operation. Image Enhancement in spatial Domain: Background, Grey level Transformation. Edge detection sharpening. Image Enhancing in Frequency Domain, background, Frequency domain, Faired Transform smarting, Sharpening, Homo-morphic filtering implementation. Image Restorations. A model of the Image Degradation/ Restoration Process, Noise Model, Restoration in the Presence of Noise-spatial filtering, Periodic Noise Reduction by frequency Domain filtering.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Give an explanation related to concepts of Digital Image Processing.	P3	PLO5
2	Show the professional commitment towards submission of lab files and project reports.	A5	PLO11
3	Perform the task related to Digital Image Processing..	P4	PLO3
4	Adapt the skills to perform the task related to Digital Image Processing.	A5	PLO8
5	Design Applications for Digital Image Processing specific requirement.	P2	PLO5

Course Title: Computer Vision
Course Code: CSC 464
Prerequisite: CEN 445
Credit Hours: 3
Contact Hours: 3

Course Content: Introduction, Image formation, Spatial and frequency domain processing, Feature detection and extraction, Image registration, Segmentation, Camera calibration, Structure from motion, Motion estimation, Stereo vision, Object detection and recognition, Object tracking, 3D scene reconstruction, Context and scene understanding, Image stitching, Image-based and video-based rendering, High-performance computing paradigms for vision and image processing

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Explain the field of computer vision in general for different applications, etc.	C2	PLO1
2	Implement an algorithm to assemble the extracted features to develop a higher-level perception	C3	PLO3
3	Understand and implement camera calibration	C2	PLO2

Recommended Books:

Text Book(s):

- D. Forsyth and J. Ponce, Prentice Hall.(2010).Computer Vision - A Modern Approach (10th Edition,) .Vikas Publishing

Reference Book(s):

- Szeliski R.(2010).Computer Vision - Algorithms and Applications (4th Edition) . Intl Thomson Business

Course Title: Secure Programming
Course Code: SEN 461
Prerequisite: None
Credit Hours: 2
Contact Hours: 2

Course Content: This course teaches the principles and practices for managing, auditing and writing secure software, including software for performing information management, networking and communications. The course addresses secure software practices and the ways of writing codes in a software so that it is protected from all kinds of accidental vulnerabilities, cyber-attacks or any event can cause harm to the software or the system using it. Software developers should be familiar with and understand the basic principles and practices for computing securely and writing secure software including: secure software design, authentication, authorization, access control, prevention of buffer-overflow attacks, security in layered networking architectures, firewalls, intrusion-detection systems, security in *(web applications, databases and information management systems)*, SQL injection attacks and defenses, applied cryptography, password management, anti-tampering and client-side security.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Describe common vulnerable programming patterns, mitigation strategies, secure software development practices, security-enhanced programming models and methodologies for security testing.	C1	PLO1
2	Explain concepts pertaining to secure programming, including SQL injection, applied cryptography, password management, anti-tampering and client-side security.	C2	PLO1
3	Solve problems related to identification and rectification of security issues when conducting code reviews.	C3	PLO2
4	Investigate the paradigm behind Secure SDLC for current and futuristic IT based systems by surveying credible and recent scientific literature.	C4	PLO4

Recommended Books:

Text Book(s):

- Michael Howard, David LeBlanc, John Viega, "24 Deadly Sins of Software Security: Programming Flaws and How to Fix Them", McGraw-Hill Education, 1st Ed, 2009.
- James N. Helfrich, Security for Software Engineers, 1st Edition, Chapman and Hall/CRC, 2018.

Reference Book(s):

- Eduardo Fernandez-Buglioni, Security Patterns in Practice: Designing Secure Architectures Using Software Patterns, 1st Edition, Wiley, 2013.
- Jason Grembi, "Secure Software Development: A Security Programmer's Guide", Cengage Learning, 1st Ed, 2008
- Software Security: Building Security In, by Gary McGraw, 2006.
- Foundations of Security. Neil Daswani, Christoph Kern, and Anita Kesavan. Apress, 1st edition, 2007.
- J. Viega, M. Messier. Secure Programming Cookbook, O'Reilly, 2003.
- M. Howard, D. LeBlanc. Writing Secure Code, Microsoft, second edition, 2002.
- J. Viega, G. McGraw. Building Secure Software, Addison Wesley, 2002.

Course Title: Secure Programming Lab
Course Code: SEN 461
Prerequisite: None
Credit Hours: 1
Contact Hours: 3

Course Content: The Lab Content include Guiding principles to secure software development, managing software security risk, selecting software development technologies (open and closed source), Software auditing, race conditions, Integer-/Buffer-overflow prevention, Format-string attack prevention, Web application security, input validation, Authentication and password management, Session Management, Database security, Data Protection and Applied cryptography.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Follow the instructions to apply security-enhanced programming models and tools to develop secure software and to troubleshoot security issues in software development.	P3	PLO5
2	Display the spirit of self-reliance to complete the lab journal timely and professionally.	A5	PLO9
3	Show the ability to act upon a sequence of setups pertaining to secure software development in response to given scenarios.	P2	PLO5
4	Develop a secure software while ensuring security goals pertaining to authentication, authorization, and access control, applied cryptography, password management, anti-tampering and client-side security.	P4	PLO3
5	Display project management skills and objective based approach to develop secure software solutions in a teamwork environment.	A5	PLO11

Humanities, Social Sciences & Management Science Electives:

Course Title: Introduction to Sociology
Course Code: HSS 217
Prerequisite: None
Credit Hours: 2
Contact Hours: 2

Course Content: This introductory course provides students with the skills to analyze society from a sociological perspective. It examines a number of pressing social problems within contemporary society and offers a comprehensive introduction to the discipline of sociology and its foundational theories. It aims to provide students with the skills to understand examine and explain broad social trends and their impact on the individual. Key sociological concepts covered include class/socioeconomic status, gender, youth, ethnicity, family, work, consumption and location.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Understand the role the social sciences play in critical discussions relating to society specifically and more broadly on a global scale;	C1	PLO1
2	Identify the characteristics of social science research, critical reading and analytical reading	C2	PLO2
3	Demonstrate productive and respectful engagement with their peers in group work	A2	PLO9

Recommended Books:

Text Book(s):

- Heather Griffiths , Nathan Keirns .(2019).Introduction to Sociology (2nd Edition) .

Reference Book(s):

- Carr, Antony , Mitchell Duneier , Richard P. Appelbaum .(2016).Introduction to Sociology .Oxford press

Course Title: Introduction to International Relation
Course Code: HSS 119
Prerequisite: None
Credit Hours: 2
Contact Hours: 2

Course Content: This course is a core course in the International Relations and provides a general introduction to the discipline of International Relations and to major themes in world politics. Major theories and approaches to world politics are covered, including Realism, Liberalism, Constructivism, Marxism, Feminism, and Postcolonial and Critical Approaches. Topics to be covered will include issues of war and peace, power, global economy, identities and ideologies, regionalism, foreign policy analysis, global civil society, justice and human rights, international organizations and empire. The course pays particular attention to the relationship between the discipline of International Relations as a field of knowledge and its application and/or relevance to the experience and interests of actors in Asia, Africa and the Middle East.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Knowledge of the major theories and approaches in the discipline of International Relations	C1	PLO1
2	Knowledge of major substantive themes in International Relations	C2	PLO1
3	Ability to critically evaluate and apply such theories and approaches	C2	PLO2

Recommended Books:

Text Book(s):

- Joseph Grieco, John Ikenberry.(2017).Introduction to International Relation : Perspective , Connections and Enduring questions (15th Edition,) .Cengage Learning

Reference Book(s):

- Robert Jackson.(2014).Introduction to International Relation theories and approaches (10th Edition) .Wadsworth Publishing

Course Title: Introduction to Media Studies
Course Code: HSS 121
Prerequisite: None
Credit Hours: 2
Contact Hours: 2

Course Content: Introduces students to the study of contemporary forms of mediated communication. The course surveys the main topics in the field and introduces students to a variety of analytical perspectives. Issues include the economics of media production; the impact of media on individual attitudes, values, and behaviors; the role of media professionals, and the impact of new media technologies.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Describe the impact of mass communication in our society	C1	PLO6
2	Analyze the evolution of communication channels with the need of surrounding environment	C4	PLO7
3	Investigate the impact of media on a given scenario	C6	PLO4
4	Present Media Studies topics clearly and professionally in front of an audience	A2	PLO10

Recommended Books:

Text Book(s):

- Alberto Cairo.(2003).The Functional Art: An introduction to information graphics and visualization (Voices That Matter) (14th Edition,) .Wadsworth Pub Co

Reference Book(s):

- Cat Hope and John Charles Ryan.(1996).Digital Arts: An Introduction to New Media (Bloomsbury New Media Series) (8th Edition,1996) .Wadsworth Publishing

Course Title: Introduction to Anthropology
Course Code: HSS 218
Prerequisite: None
Credit Hours: 2
Contact Hours: 2

Course Content: The course will focus on the field of Cultural Anthropology. It will answer the question: "What is Anthropology" by introducing the history of the discipline, theoretical approaches, anthropological research methods and the central concept of culture. It will then look at some of the major areas that have been the focus of anthropological inquiry: Family, Means of Production, Political Organizations, Language, Religion, and Gender. The course will also examine the application of Anthropology in different sectors.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Explain the field of Cultural Anthropology	C1	PLO1
2	Compare anthropological research methods and the central concept of culture	C2	PLO2
3	Present Cultural Anthropology in group	A2	PLO9

Recommended Books:

Text Book(s):

- Robert Jurmain, Lynn Kilgore.Introduction to physical Anthropology.

Reference Book(s):

- James Peoples and Garrick Bailey..Humanity: Introduction to Cultural Anthropology .

Course Title: Organizational Behavior
Course Code: HSS 457
Prerequisite: None
Credit Hours: 2
Contact Hours: 2

Course Content: Introduction and background to organizational behavior, Organization: structure and design, Organizational culture, Organizational change and development, Foundations of individual behavior, Behavior modification, Socialization and mentoring, Work group behavior, Organizational conflicts management

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Explain key concepts, theories, and models related to human behavior in an organizational system and apply these to current business situations and issues;	C1	PLO12
2	Identify internal and external factors that influence change in an organization;	C2	PLO12
3	Provide a framework to establish group roles and responsibilities, facilitate decision-making, maintain tasks, and manage ongoing group communication;	A2	PLO9

Recommended Books:

Text Book(s):

- Angelo Kinicki and Fugate Associate Professor, Mel.(2013).Organizational Behavior (9th Edition) .McGraw-Hill Education

Reference Book(s):

- Robins.(2014).Organizational Behavior.Routledge

Course Title: Introduction to Psychology
Course Code: PSY 102
Prerequisite: None
Credit Hours: 2
Contact Hours: 2

Course Content: This course is designed to increase student's success in university, work life and in personal life. This will help increase in self-awareness, set and pursue meaningful goals, and develop positive personal qualities such as self-esteem, a positive attitude, self-discipline, and self-motivation. Furthermore, exploring personality, interests and values to increase self-understanding and select an appropriate major and career. Examine adult stages of development and develop a plan for wellness and living a long and healthy life. Learn strategies for motivation and stress management.

This course will also help you adjust to transitions in life. By participating in class activities and discussions and by completing the activities in your text, you will build a valuable record of your dreams, goals, skills, interests, values, and more.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Demonstrate knowledge of major perspectives in psychology by identifying key concepts and identifying major theories	C1	PLO6
2	Demonstrate knowledge of major perspectives in psychology by recognizing major outlooks of everyday living (real life examples)	C1	PLO7
3	Demonstrate knowledge of the scientific process in psychology by identifying the basic steps of the scientific method and identifying commonly used research methods such as the experiment, correlation, survey, and case study	C2	PLO4
4	Apply applications of the major perspectives to areas including development, personality, mental health, learning, and memory	C3	PLO6

Recommended Books:

Text Book(s):

- Hilgard.(2018).Introduction to Psychology (10th Edition) .W. W. Norton & Company

Reference Book(s):

- Schultz, Duane P..(2014).A History of Modern Psychology .Perennial

Course Title: Software Engineering Economics
Course Code: SEN 442
Prerequisite: None
Credit Hours: 2
Contact Hours: 2

Course Content: Programming aspects, economic aspects, human relations aspects, software trends: cost, social impact, the plurality of SE Means, The GOALS Approach to Software Engineering, The Software Work Breakdown Structure (WBS), Software Maintenance, introduction to COCOMO, definitions and assumptions, development effort and schedule, phase distribution, The Rayleigh Distribution, interpolation, basic software maintenance effort estimation. Performance Models, Optimal Performance, Sensitivity Analysis, Cost-effectiveness Models. Cost Drivers: Project Attributes–Modern Programming Practices, Use of Software Tools, Schedule Constraint.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Describe economic analysis techniques and their applicability to software engineering	C1	PLO1
2	Develop software cost estimation skills using industry standards	C3	PLO1
3	Critically evaluate and discuss the issues in cost estimation of different applications in the real world with course participants and learners	C4	PLO4

Recommended Books:

Text Book(s):

- Shari Lawrence Pfleeger.(2007).Software Cost Estimation and Sizing Methods, Issues, and Guidelines (2nd Edition,) . McGraw-Hill Education

Reference Book(s):

- Pamela T. Geriner, Thomas R. Gulledge.(1991).Software Engineering Economics and Declining Budgets .Computing McGraw-Hill
- Capers Jones.(1996).Estimating Software Costs: Bringing Realism to Estimating .McGraw-Hill

Course Title: English Literature
Course Code: ENG 123
Prerequisite: None
Credit Hours: 2
Contact Hours: 2

Course Content: This course introduces students to the joys and skills required in English literary studies. Students will examine a variety of texts and genres, including novels, short stories, drama, and poetry, together with contemporary techniques for reading them. The course will develop students? Skills in literary and critical analysis, writing, and research

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Confidently read and understand a range of literary texts.	C1	PLO1
2	Understand different approaches to, and methods of representing, 'the real'.	C2	PLO2
3	Analyze literary forms in the context of major developments in literary history.	C4	PLO10

Recommended Books:

Text Book(s):

- Stephen Greenblat.(2019).The Norton Anthology of English Literature (8th Edition) .Boston: Pearson Education

Reference Book(s):

- Thomas C Foster.(2019).How to Read Literature Like a Professor: A Lively and Entertaining Guide to Reading Between the Lines (7th Edition) .Boston: Pearson Education.

Course Title: Foreign Language
Course Code: HSS 462
Prerequisite: None
Credit Hours: 2
Contact Hours: 2

Course Content: He/she learns how to make simple enquiries in speaking and writing and to give instructions, builds on his/her basic grammar skills and increases his/her vocabulary. The following language functions are among those practiced: asking the way; giving directions; asking for and giving information; discussing home and the household; describing people and their character; defining shape, size and color of objects; asking for and giving opinions; the working world; returning faulty goods to a shop.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Explain different words and give their detail uses	C1	PLO10
2	Present any topic using specific language Confidently and professionally	A2	PLO10
3	Acquire the knowledge of basic strokes and radicals to read and write the Chinese characters efficiently	C1	PLO12

Recommended Books:

Text Book(s):

Reference Book(s):

Course Title: Accounting & Finance
Course Code: HSS 461
Credit Hours: 2
Prerequisite:

Course Content: Introduction: Purpose and Nature of Accounting, Various areas of Accounting Forms of Business enterprises, Accounting Information users, GAAP, Conversion, Business transaction and Accounting equation; Accounting Process: Recording changes in financial position, Double entry Accounting system, Journal, Ledger, Trial Balance; The Accounting cycle: Measuring business income, adjusting process, Completion of Accounting Cycle, Work sheet, Financial Statements; The control of Cash transaction and Bank Reconciliation; Accounting for receivables accounting for Inventory, Accounting for depreciation of fixed assets, Deprecation Methods

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Describe the objective of financial reporting, the elements of the financial statements, and the related key accounting assumptions and principles	C1	PLO1
2	Recognize the information conveyed financial statements and the way it is used by investors, creditors, regulators, and managers	C3	PLO2
3	Analysis of risk and return for portfolio management	C4	PLO2
4	Investigate the importance of cost accounting in manufacturing process and preparation of cost of goods sold/ Income statement	C5	PLO3

Recommended Books:

Text Book(s):

- I M Pandey.(2001).Financial Management (Volume 1 & 2) .McGraw-Hill Education

Reference Book(s):

- GM Samuels , F M Wikes.(2012).Management of Company Finance (1st Edition) .New Riders
- Robert F.Meigs .(2014).Accounting: The Basis for Business Decisions .Bloomsbury Academic

Course Title: Entrepreneurship and Leadership
Course Code: HSS 423
Prerequisite: None
Credit Hours: 3
Contact Hours: 3

Course Content: This course provides an overview about the potential to be entrepreneur, and to explore the ingredients of the entrepreneurial process, demonstrate the ability to provide a self-analysis in the context of an entrepreneurial career and select the best business according to your resources and finance. The best practices of Leadership and their different characteristics, differentiation of Management and Leadership, comprehend the core concepts and theories of entrepreneurship. Acquire entrepreneurship skills including creativity, risk-taking, employability, and transferability to creating an appropriate business plan and select suitable business model successfully turning a business idea into business venture.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Define the fundamental concepts of Entrepreneurship & Leadership	C1	PLO1
2	Apply entrepreneurial practices into business venture	C3	PLO1
3	Analyze the importance of leadership skills relevant to a specific domain	C4	PLO2
4	Evaluate an appropriate business plan and select suitable business model	C6	PLO12

Recommended Books:

Text Book(s):

- Robert D. Hisrich, Michael P, Dean A..(2010).Entrepreneurship Hisrich (1st Edition) .John Wiley & Sons

Reference Book(s):

- Peter Drucker.(2013).Innovation and Entrepreneurship (Routledge Classics) (2nd Edition) .OpenStax
- Alexander O., Yves P.(2015).Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers (11th Edition) .W. W. Norton & Company

Course Title: Principles of Management
Course Code: MGT 111
Prerequisite: None
Credit Hours: 3
Contact Hours: 3

Course Content: This module introduces students to the principles of management. It starts by considering organizational objectives and how management functions may be combined to achieve them in the context of a changing business environment. Topics covered include: strategy and planning; financial management; human resource management; organization; governance; cross cultural management; motivation; innovation and technology; marketing; leadership and control; business ethics; environmental management strategies; the external business environment; price and non-price competition; the regulatory environment. Each of these topics is considered individually before discussing how different management functions combine and interact with each other and with external factors to shape organizational and business performance.

Each topic is considered in the context of the theoretical and empirical literature using key readings, quantitative and qualitative empirical evidence and cases.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Demonstrate core functions of management	A2	PLO12
2	Demonstrate combination of core functions via strategy and planning	A2	PLO12
3	Demonstrate internal and external factors combine to shape organizational performance	A2	PLO12

Recommended Books:

Text Book(s):

- Ogilvie, Dr John..Principles of Management (11th Edition) .McGraw-Hill Education;

Reference Book(s):

- Vibrant publisher..Principles of Management Essentials (3rd Edition) .Routledge

Course Title: Human Resource Management
Course Code: HSS 453
Prerequisite: None
Credit Hours: 3
Contact Hours: 3

Course Content: An overview of Human Resource Management and Human. Resource Manager. The Environment of Human Resource Management, external and Internal Environment. Equal Employment Opportunity and Affirmative Action. Job Analysis: A Basic Human Resource Tool. Human Resource Planning, Recruitment, and Selection. Organization Change and Human Resource Development. Corporate Culture and Organization Development. Career Planning Development. Performance Appraisal.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Explain Human Resource Planning, Recruitment, and Selection	C1	PLO1
2	Compare Corporate Culture and Organization Development	C2	PLO2
3	Present Environment of Human Resource Management professionally and confidently	A2	PLO9

Recommended Books:

Text Book(s):

- Wayne F. Cascio.Managing Human Resource (2nd Edition) .McGraw-Hill Education

Reference Book(s):

- John Stredwick.Introduction to Human Resource Management (18th Edition) .Pearson

Course Title: Engineering Management
Course Code: MGT 423
Prerequisite: None
Credit Hours: 3
Contact Hours: 3

Course Content: Engineering management course includes following content: Engineering Ethics and Professionalism, Legal Aspects of Engineering, Motivation Theory, Operations Research, Quality Control, Project Control, Forecasting and Decision Making, Risk Management.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Explain Human Resource, Legal Aspects of Engineering, Motivation Theory etc	C1	PLO1
2	Compare different legal Aspect of engineering	C2	PLO2
3	Present issues facing managers in engineering, construction and employment law	A2	PLO9

Recommended Books:

Text Book(s):

- Fraidoon Mazda, Engineering Management, Pearson Education, 1998

Reference Book(s):

- Babcock, D. L. and Morse, L. C., Managing Engineering & Technology, 3rd ed., Prentice hall, 2002.
- Rockrath, Joseph T., Contracts, Specifications, and Law for Engineers, McGraw Hill, New York, New York.
- Schuab, Pavlovic, and Morris, Engineering Professionalism and Ethics, Wiley Interscience, New York, New York.

Course Title: Introduction to Maritime Industry
Course Code: MTM 101
Prerequisite: None
Credit Hours: 3
Contact Hours: 3

Course Content: This course is consist on facts and figures highlighting the importance of shipping to the world of trade; it will define brief introduction to types of ships Geographical origins and destination of major cargo; Maritime Perils, Meteorology; Role of Broker, Charterers, Shipper, Carrier, Consignee, Distributor, Retailer and end-user; Contracts of carriage, Charter parties, Shipping services; Port operations, Concepts of Maritime logistics; Basics of Shipping economics; Ship management, Quality control; Ship Operations; Ship board operations, Seaworthiness; Maritime Legal Infrastructure, Jurisdiction; Maritime Safety and Security, Marine pollution, Maritime Environmental issues.

Course Learning Outcomes:

CLO	Statement	Bloom's Taxonomy	Associated PLO
1	Describe the various commercial, industrial and government sectors comprising the maritime industry	C1	PLO1
2	Explain the relationships between the sectors of the maritime industries.	C2	PLO2
3	Discuss the significance of the maritime industry to domestic and industrial trade and sustainable development	C3	PLO7

Recommended Books:

Text Book(s):

- Gross, Oceanography: A view of the Earth, 6th Ed., 1996, Pearson.
- Branch's Elements of Shipping, 9th Ed, 2014, Routledge.

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