Department of Computer Software Engineering

Revised Curriculum of BSc. Program

Recommended by BoS in its meeting held on: 15-05-2019 and BoF in its meeting held on: 21-05-2019

University of Engineering & Technology, Mardan

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1. Program Structure

The structure of BSc. Computer Software Engineering is shown in the following table:

Duration:	4 Years
Number of Semesters:	8 semesters
Number of Weeks per Semester:	18 (16 for teaching and 2 for mid and final exams)
Total Number of Credit Hours:	135
Number of Credit Hours per Semester:	15(min) to 19(max)
Medium of Instruction:	English

2. Distribution of Courses

The following table shows the distribution of courses in various knowledge domains for the BSc. Computer Software Engineering Program

Major Area	**Core (Credit Hours)**	**Electives (Credit Hours)**	**Credit Hours (Core+ Electives)**	**Percentage of Credit Hours**	**Percentage of Engineering & Non-Engineering**
Computing	44	--	44	32.6 %	68.9%
Software Engineering	25	15	40	29.6 %	
Software Engineering Supporting	--	9	9	6.7%	
Maths /Science Foundation	12	--	12	8.9%	31.1%
General Education	18	12	30	22.2%	
Total Credit Hours			**135**		

3. Detail of Courses in Each Knowledge Domain

Computing Core Courses			
S. No	**Course Code**	**Course Title**	**Credit Hours**
1	SE101	Introduction to Computing	2
2	SE-101L	Introduction to Computing Lab	1
3	SE-102	Introduction to Programming	3
4	SE-102L	Introduction to Programming Lab	1
5	SE-103	Discrete Structures	3
6	SE-104	Object Oriented Programming	3
7	SE-104	Object Oriented Programming Lab	1
8	SE-202	Data Structures and Algorithms	3
9	SE-202L	Data Structures and Algorithms Lab	1
10	SE-204	Introduction to Software Engineering	3
11	SE-209	Introduction to Database Systems	3
12	SE-209L	Introduction to Database Systems Lab	1
13	SE-304	Operating Systems	3
14	SE-304L	Operating Systems Lab	1
15	SE-305	Computer Communication and Networks	3
16	SE-305L	Computer Communication and Networks Lab	1
17	SE-309	Entrepreneurship	2
17	SE-327	Information Security	3
19	SE-405	Final Year Project	6
Total Credit Hours in Computing Core:			**44**

Software Engineering Core Courses			
S. No	**Course Code**	**Course Title**	**Credit Hours**
1	SE-207	Software Requirements Engineering	3
2	SE-302	Software Design and Architecture	2
3	SE-302L	Software Design and Architecture Lab	1
4	SE-206	Software Construction and Development	2
5	SE-206L	Software Construction and Development Lab	1
6	SE-307	Software Quality Engineering	3
7	SE-301	Web Engineering	3
8	SE-301L	Web Engineering Lab	1
8	SE-401	Human Computer Interaction	3
9	SE-402	Software Project Management	3
10	SE-410	Software Re-Engineering	3
Total Credit Hours in Software Engineering Core:			**25**
Software Engineering Elective Courses			
S. No	**Course Code**	**Course Title**	**Credit Hours**
1	SE-***	SE Elective-I	3
2	SE-***	SE Elective-II	3
3	SE-***	SE Elective-III	3
4	SE-***	SE Elective-IV	3
5	SE-***	SE Elective-V	3
Total Credit Hours in Software Engineering Electives:			**15**
Software Engineering Supporting Elective Courses			
S. No	**Course Code**	**Course Title**	**Credit Hours**
1	SE-***	SE Supporting Elective-I	3
2	SE-***	SE Supporting Elective-II	3
3	SE-***	SE Supporting Elective-III	3
Total Credit Hours in Software Engineering Supporting Electives:			**9**
Natural Sciences Core Courses			
S. No	**Course Code**	**Course Title**	**Credit Hours**
1	BSH-140	Calculus & Analytical Geometry	3
2	BSH-130	Applied Physics	3
3	BSH-142	Linear Algebra	3
4	BSH-341	Probability and Statistics	3
Total Credit Hours in Natural Sciences:			**12**
General Education Core Courses			
S. No	**Course Code**	**Course Title**	**Credit Hours**
1	BSH-101	Islamic Studies	2
2	BSH-103	English Composition & Comprehension	3
3	BSH-201	Communication & Presentation Skills	3
4	BSH-102	Pakistan Studies	2
5	BSH-110	Professional Practices	3
6	BSH-301	Technical Writing	3
7	BSH-***	Environment & Sustainability	2
Total Credit Hours in General Education:			**18**
General Education/University Elective Courses			
S. No	**Course Code**	**Course Title**	**Credit Hours**
1	BSH-***	General Education Elective-I	3
2	BSH-***	General Education Elective-II	3
3	BSH-***	General Education Elective-III	3
4	BSH-***	General Education Elective-IV	3
Total Credit Hours in General Education Electives:			**12**

4. List of Elective Courses in Each Domains

List of Software Engineering Elective Courses			
S. No	**Course Code**	**Course Title**	**Credit Hours**
1	SE-***	Agent Based Software Engineering	3
2	SE-***	Big Data Analytics	3
3	SE-***	Cloud Computing	3
4	SE-***	Computer Graphics	3
5	SE-***	Data Encryption and Security	3
6	SE-***	E-Commerce	3
7	SE-***	Game Application Development	3
8	SE-***	Global Software Development	3
9	SE-***	Information System Audit	3
10	SE-***	Management Information System	3
11	SE-***	Mobile Application Development	3
12	SE-***	Multimedia Communication	3
13	SE-***	Natural Language Processing	3
14	SE-***	Real Time Systems	3
15	SE-***	Semantic Web	3
16	SE-***	Software Engineering Economics	3
17	SE-***	Software Metrics	3
19	SE-***	Systems Programming	3
20	SE-***	Topics in Software Engineering	3
21	SE-***	Visual Programming	3
22	SE-***	Artificial Intelligence	3
List of Software Engineering Supporting Elective Courses			
S. No	**Course Code**	**Course Title**	**Credit Hours**
1	SE-***	Business Process Engineering	3
2	SE-***	Formal Methods in Software Engineering	3
3	SE-***	Operation Research	3
4	SE-***	Simulation and Modelling	3
5	SE-***	Stochastic Processes	3
List of General Education Elective Courses			
S. No	**Course Code**	**Course Title**	**Credit Hours**
1	BSH-310	Psychology	3
2	BSH-220	Principles of Management	3
3	BSH-221	Human Resource Management	3
4	BSH-120	Economics	3
5	BSH-***	Sociology	3
6	BSH-***	English Literature	3
7	BSH-***	Organizational Behaviour	3
8	BSH-***	Accounting and Finance	3
9	BSH-***	Intellectual Property Rights	3

Note:

1. One credit hour is equal to 3 contact hours for Lab course and 1 contact hour for theory course.
2. Elective courses in SE, SE Supporting and General Education domains will be selected in a semester from the list of elective in each domain based on the availability of instructor, market trend and fulfilling the required number of students' registrations.
3. Codes to BSH-*** and SE-*** will be assigned by the Department according to the elective course selected.
4. Theory and Lab are treated as separate courses.
5. Lab courses have "L" at the end of Course Code.

5. Scheme of Studies of BSc. Computer Software Engineering

1st Semester					
Course Code	**Course Title**	**Credit Hours**	**Contact Hours**	**Knowledge Area**	**Pre-Requisite**
SE-101	Introduction to Computing	2	2	Computing(Breadth)	None
SE-101L	Introduction to Computing Lab	1	3	Computing(Breadth)	None
SE-102	Introduction to Programming	3	3	Computing(Breadth)	None
SE-102L	Introduction to Programming Lab	1	3	Computing(Breadth)	None
BSH-101	Islamic Studies	2	2	General Education	None
BSH-140	Calculus & Analytical Geometry	3	3	Natural Sciences	None
BSH-103	English Composition & Comprehension	3	3	General Education	None
	Total Contact Hours	**--**	**19**		
	Total Credit Hours	**15**	**--**		
2nd Semester					
Course Code	**Course Title**	**Credit Hours**	**Contact Hours**	**Knowledge Area**	**Pre-Requisite**
SE-103	Discrete Structures	3	3	Computing(Breadth)	None
SE-104	Object Oriented Programming	3	3	Computing(Breadth)	SE-102
SE-104L	Object Oriented Programming Lab	1	3	Computing(Breadth)	SE-102
BSH-130	Applied Physics	3	3	Natural Sciences	None
BSH-201	Communication & Presentation Skills	3	3	General Education	None
BSH-***	General Education Elective-I	3	3	General Education	None
	Total Contact Hours	**--**	**18**		
	Total Credit Hours	**16**	**--**		
3rd Semester					
Course Code	**Course Title**	**Credit Hours**	**Contact Hours**	**Knowledge Area**	**Pre-Requisite**
SE-202	Data Structures & Algorithms	3	3	Computing(Breadth)	SE-104
SE-202L	Data Structures & Algorithms Lab	1	3	Computing(Breadth)	SE-104
SE-204	Introduction to Software Engineering	3	3	Computing(Breadth)	None
BSH-102	Pakistan Studies	2	2	General Education	None
BSH-142	Linear Algebra	3	3	Natural Sciences	None
BSH-110	Professional Practices	3	3	General Education	None
BSH-***	General Education Elective-II	3	3	General Education	None
	Total Contact Hours	**--**	**20**		
	Total Credit Hours	**18**	**--**		
4th Semester					
Course Code	**Course Title**	**Credit Hours**	**Contact Hours**	**Knowledge Area**	**Pre-Requisite**
SE-207	Software Requirements Engineering	3	3	SE Core(Breadth)	SE-204
SE-209	Introduction to Database Systems	3	3	Computing(Breadth)	None
SE-209L	Introduction to Database Systems Lab	1	3	Computing(Breadth)	None
SE-304	Operating Systems	3	3	Computing(Breadth)	None
SE-304L	Operating Systems Lab	1	3	Computing(Breadth)	None
BSH-341	Probability and Statistics	3	3	Natural Sciences	None
BSH-***	General Education Elective-III	3	3	General Education	None
	Total Contact Hours	**--**	**21**		
	Total Credit Hours	**17**	**--**		

5th Semester					
Course Code	**Course Title**	**Credit Hours**	**Contact Hours**	**Knowledge Area**	**Pre-Requisite**
SE-302	Software Design & Architecture	2	2	SE Core(Breadth)	SE-207
SE-302L	Software Design & Architecture Lab	1	3	SE Core(Breadth)	None
SE-305	Computer Communication & Networks	3	3	Computing(Breadth)	None
SE-305L	Computer Communication & Networks Lab	1	3	Computing(Breadth)	None
BSH-301	Technical Writing	3	3	General Education	None
BSH-***	Environment & Sustainability	2	2	General Education	None
SE-***	SE Supporting Elective-I	3	3	SE(Supporting)	None
SE-***	SE Supporting Elective-II	3	3	SE (Supporting)	None
	Total Contact Hours	**--**	**22**		
	Total Credit Hours	**18**	**--**		
6th Semester					
Course Code	**Course Title**	**Credit Hours**	**Contact Hours**	**Knowledge Area**	**Pre-Requisite**
SE-206	Software Construction & Development	2	2	SE Core(Breadth)	SE-302
SE-206L	Software Construction & Development Lab	1	3	SE Core(Breadth)	SE-302
SE-307	Software Quality Engineering	3	3	SE Core(Breadth)	SE-204
SE-327	Information Security	3	3	Computing(Breadth)	None
SE-301	Web Engineering	3	3	SE Core(Breadth)	None
SE-301L	Web Engineering Lab	1	3	SE Core(Breadth)	None
SE-***	SE Elective-I	3	3	SE Elective(Depth)	++
SE-***	SE Supporting Elective-III	3	3	SE (Supporting)	None
	Total Contact Hours	**--**	**23**		
	Total Credit Hours	**19**	**--**		
7th Semester					
Course Code	**Course Title**	**Credit Hours**	**Contact Hours**	**Knowledge Area**	**Pre-Requisite**
SE-401	Human Computer Interaction	3	3	SE Core(Breadth)	SE-204
SE-402	Software Project Management	3	3	SE Core(Breadth)	SE-204
SE-309	Entrepreneurship	2	2	Computing(Breadth)	None
SE-***	SE Elective-II	3	3	SE Elective(Depth)	++
SE-***	SE Elective-III	3	3	SE Elective(Depth)	++
SE-405a	Final Year Project	3	9	Design Project	None
	Total Contact Hours	**17**	**23**		
8th Semester					
Course Code	**Course Title**	**Credit Hours**	**Contact Hours**	**Knowledge Area**	**Pre-Requisite**
SE-410	Software Re-Engineering	3	3	SE Core(Breadth)	SE-206
SE-***	SE Elective-IV	3	3	SE Elective(Depth)	++
SE-***	SE Elective-V	3	3	SE Elective(Depth)	++
SE405b	Final Year Project	3	9	Design Project	None
BSH-***	General Education Elective-IV	3	3	General Education	None
	Total Contact Hours	--	**23**		
	Total Credit Hours	**17**			

Total Credit Hours: 135

++ Prerequisite for these courses will be defined by the department at the time of offering.

6. Course Contents of Core Courses

1st Semester

SE-101 Introduction to Computing

Prerequisite: None

Contact Hours:
Theory =32

Credit Hours:
Theory = 2.0

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1	***Explain*** the history, types and building blocks(hardware components) of computer system.	Cognitive	2	1
2	***Illustrate*** the importance and use of system and application software and ***Outline*** the basic concepts of Computer Networks , Internet and world wide web.	Cognitive	2	1
3	***Understand*** the impact of Green Computing as sustainable engineering solution in societal and environmental context	Cognitive	2	7

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☑
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:
Data and Information, Number Systems, History of Computing & Categories of Computer, Understanding Components of Computer system, Peripheral Devices(Data Entry Devices and Output Devices), Processor, RAM and its types, Computer Networks and its Types, Network Connecting Devices(Routers, Bridges, Switches and Hubs), System Software and its Types, Application Software and its Types, Impact of digital solutions on environment, History and Basics of Green Computing, Importance of Green Computing, Kiosks and its Types, Storage Devices(Magnetic Disks and Optical Disks) , Protocols used for Networking, Cyber Security, History and Categories of Computer Virus and Antivirus.

Teaching Methodology
- Lecturing

Assessment:
- **Sessional (25%):** Quizzes, Assignments
- **Mid Term (25%)**
- **Final Term (50%)**

Text& Reference book:

1. Computers by Larry Long and Nancy Long (11th Edition), ISBN-10:0131405810, Publisher Prentice Hall Publication, Year of Publication: 2003.
2. Introduction to Computers by Peter Norton (4th edition), ISBN-10: 0078210585, Publisher: Mcgraw-hill Professional, Publication Year: 2000.

SE-101L Introduction to Computing Lab

Contact Hours:
Lab = 48

Credit Hours:
Lab = 1.0

COURSE LEARNING OUTCOMES:

Upon successful completion of the lab, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Demonstrate*** knowledge about the practical aspects of computer system.	Cognitive	2	1
2.	***Acquire*** knowledge of different features of Operating Systems and typing tools to achieve the ability for developing solutions of Engineering problems.	Psychomotor	2	3
3.	***Justify*** time and resource allocation to complete the assigned task	Affective	3	11
4.	***Report*** the outcome of an experiment/task in standard format.	Affective	2	10

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☑
5	Modern Tool Usage:	☐	11	Project Management:	☑
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

List of Experiments:

S#	Experiment Descriptions
1.	Identification of Parts of Computer
2.	Computer Keyboard Shortcuts and Special Characters
3.	Acquaintance with the use of Graphical User Interface on Operating System (Desktop, Start menu , Taskbar and graphical icons)
4.	Study of Components of Central Processing Unit
5.	Acquaintance with use of Picture Editor
6.	Acquaintance with use of Text Editor
7.	Electronic mail and E-mail Application.
8.	Acquaintance with use of web browser and search engine for better use of internet for knowledge.
9.	Acquaintance with use of Word Processing Editor
10.	MS Word and Use of tables in documents
11.	Acquaintance with use of MS Power Point
12.	Using Custom Animation in MS PowerPoint Presentation
13.	Acquaintance with use of spreadsheet Editor MS Excel
14.	Google Doc, Google Sheet, Google Slides and Office Lens(Pocket Scanner)

Teaching Methodology: Lab Demonstration, Lab Tasks

Assessment

- **Sessional (25%)**
  - Lab Tasks
- **Mid Term (25%)**
- **Final Term and Viva Voce (50%)**

Text & Reference books:

1. Introduction to Computing, Lab Manual.
2. Microsoft Office (Right PHit)
3. Microsoft Office (Right PHit)

SE-102 Introduction to Programming

Prerequisite: None

Contact Hours:
Theory =48

Credit Hours:
Theory = 3.0

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Understand*** basic problem solving steps and logic constructs	Cognitive	2	1
2.	***Apply*** basic programing concepts	Cognitive	3	3
3.	***Analyze*** and implement algorithms to solve real world problems.	Cognitive	4	2

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:
Introduction to problem solving, a brief review of Von-Neumann architecture, Introduction to programming, role of compiler and linker, introduction to algorithms, basic data types and variables, input/output constructs, arithmetic, comparison and logical operators, conditional statements and execution flow for conditional statements, repetitive statements and execution flow for repetitive statements, lists and their memory organization, multi-dimensional lists, introduction to modular programming, function definition and calling, stack rolling and unrolling, string and string operations, pointers/references, static and dynamic memory allocation, File I/O operations

Teaching Methodology
- Lecturing

Assessment
- **Sessional (25%)**
  - Assignments/Projects
  - Quizzes
- **Mid Term (25%)**
- **Final Term (50%)**

Text & Reference books:

1. Turbo C, by Robert lafore.
2. Let us C, by Yashavant Kanetka
3. The C Programming Language, 2nd Edition by Brian W. Kernighan, Dennis M. Ritchie
4. Object Oriented Programming in C++ by Robert Lafore.
5. Introduction to Computation and Programming Using Python: With Application to Understanding Data, 2nd Edition by Guttag, John.
6. Practice of Computing Using Python, 3rd Edition by William Punch & Richard Enbody.
7. C How to Program, 7th Edition by Paul Deitel & Harvey Deitel
8. Problem Solving and Program Design in C++, 7th Edition by Jeri R. Hanly & Elliot B. Koffman

SE-102L Introduction to Programming Lab

Prerequisite: None

Contact Hours:
Lab =48

Credit Hours:
Lab = 1.0

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Implement*** various programming concepts to perform logical and computational tasks.	Psychomotor	3	3
2.	***Justify*** time and resource allocation to complete the assigned task	Affective	3	11
3.	***Report*** the outcome of an experiment/task in standard format.	Affective	2	10
4.	***Demonstrate*** knowledge about the practical aspects of Introduction of Programming Lab Course	Cognitive	2	1
5.	***Work*** effectively as an individual or in team to solve real world problems.	Affective	3	9

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☑
4	Investigation:	☐	10	Communication:	☑
5	Modern Tool Usage:	☐	11	Project Management:	☑
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

List of Experiments:

S#	Descriptions
1.	Programming in C and exploring Turbo C IDE
2.	Variables (declaring and assigning values to variables), Displaying output to the user (printf), Receiving input from the user (scanf)
3.	Arithmetic Operators (multiplication, division, modulus, addition and subtraction)
4.	Relational and logical operators (less than or equal to, greater than or equal to, greater than, less than, equal to and not equal to), Decision or selection statements (if, if-else, switch)
5.	Repetition statements (For Loop and nested For Loop)
6.	Repetition statements (While, do-while, nested while loop), break and continue statements
7.	Functions, call by value, call by reference
8.	Arrays, adding values to an array, retrieving values from array
9.	Pointers (referencing, dereferencing)
10.	Strings (declaration and initialization of string array, string comparison, concatenation of strings, copying one string into another)
11.	Storage classes, global static variables
12.	Structures, declaration and initialization of structures, structure's members
13.	Arrays of structures (declaration, initialization and retrieving values from array of structure)
14.	File Handling (open, reading and writing a file)
15.	Open Ended Lab

Teaching Methodology

- Demonstration
- Lab Tasks
- Open Ended Lab

Assessment

- **Sessional (25%)**
- **Mid Term (25%)**
- **Final Term (25%)**
- **Viva Voce Examination (25%)**

Teaching Material: Introduction to Programming Lab Manual.

BSH-101 Islamic Studies

Prerequisite: None

Contact Hours:
Theory =32

Credit Hours:
Theory = 2.0

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Discuss*** basic concepts of Islam (faith, pillars, dawat, preaching and seerat).	Cognitive	2	12
2.	***Explain*** Basic Concepts of Hadith and Compilation of the Holy Quran	Cognitive	2	12
3.	***Discuss*** Islam as a complete code of life.	Cognitive	2	8

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☐	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☑
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☑

Course outline:
Compilation of the Holy Quran and Hadith, Fundamental doctrine of Islam i.e Tawheed, oneness of Allah, Prophet hood, the day of Judgment, Revealed books, Ibadaat (worship) Philosophy of Ibadaat, Namaz, Zakat, Hajj & Sawm, Importance of preaching of Islam, its needs and effects, Difficulties in the ways of preaching of Islam, Sectarianism, its causes and effects in Muslim society, Definition of Right, classification of right, importance of Rights, Khutba Hajjatul Wida (last Address of the Holy Prophet Peace be upon him), Seeratun-Nabi (Peace Be upon him), The life of the Holy prophet before and after prophet hood. The Hijra (Migration to Madina), Treaty of Al madina, Makki and Madani Life of Holy Prophet Muhammad (Peace be upon him), Importance of peace and causes of Terrorism, Definition of civilization, Impacts of Islamic civilization on the Sub-continents, International impacts of Islamic civilization, Impacts of Human thoughts, social and humanistic effects, Importance of Ethics, Human rights (Hoqooq Ul Ibad) with detail, Definition of Knowledge, Classification of knowledge, Importance of technology in the light of Holy Quraan and Sunnah, Relevent verses of the Holy Quran about Technology (Baqara 28,30,33,201, Nahal:76, Jasia: 13, Araf: 32, Noor: 55 etc), Islamic and scientific knowledge.

Teaching Methodology: Lecturing

Assessment: Mid Term (25%)**,** Final Term (50%)**,** Sessional Marks (25%)

Text book:

- A guide book for Muslims by Syed. Abul Hasan Ali Nadvi.
- An Introduction to Islam by Dr. Muhammad hameedullah.
- What is Islam by Maulana Manzoor Nomani.
- Islamiat (A standard book for CSS), Prof. Dr. Arif Naseem.
- Islamiat for Students O levels, Farkhanda Noor Muhammad.

BSH-140 Calculus & Analytical Geometry

Prerequisite: None

Contact Hours:
Theory =48

Credit Hours:
Theory = 3.0

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Understand*** the ideas of rate of change and derivatives using the concept of limits and continuity.	Cognitive	1	1
2.	***Use*** the techniques of integration for solving and analyzing problems in integral calculus.	Cognitive	3	1
3.	***Apply*** the derivatives for solving different problems arising in engineering sciences.	Cognitive	3	1
4.	***Use*** the vector calculus and analytical geometry in multiple dimensions to solve different problems.	Cognitive	3	1

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

Type of Functions (continuous, periodic, odd, even), graphs of functions, Limits and continuity, Derivatives, total differential, Higher odder derivative, Tangents and normal, approximation by Taylor and McLaurin's, Maxima & Minima and Point of inflection, Indeterminate form Integral Calculus (basic concepts, Integral formula, some rules of integral), Integration by parts, area bounded by curve, volume of revolution. Basic Concept function of several variables, limits and continuity, Partial Derivative, Higher order partial derivative.

Teaching Methodology

- Lecturing

Assessment: Sessional (25%) Mid Term (25%) Final Term (50%)

Text book:

- Calculus by Thomas Finney, Addison-Wesley Publishing Company.
- Mathematics for Engineer 2nd Edition by Robert Davison.

BSH-103 English Composition & Comprehension

Prerequisite: None

Contact Hours:
Theory =48

Credit Hours:
Theory = 3.0

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO	Domain	Taxonomy level	PLO
1.	Apply the acquire knowledge and skill of communication in their respective fields of engineering.	Cognitive	3	9
2.	Consolidate and extend students' vocabulary and grammar, that will enable them to present and contribute towards drafting of text effectively.	Affective	3	10
3.	Exhibit sound vocabulary and skills to use English in professional life.	Affective	2	12

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☐	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☑
4	Investigation:	☐	10	Communication:	☑
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☑

Course outline:
Composition: Vocabulary Building skills, Words & expressions commonly misused, Articles; their use, Prepositions; Prepositional phrases, Punctuations, Common Grammatical mistakes, Elementary Principles of Composition, Relative Pronouns & Clauses, Conditional Sentences & types, Adverbs & Adjectives; their forms & use.
Comprehension: Getting the essential information, Finding the main idea**,** Defining vocabulary in context, Practice.
Order of importance: Using order in the writing to determine what is most important to the author Similarities & Differences; using comparisons to determine the author's attitude Sentence structure, degree of detail, description & tone, Practice.
Critical reading & thinking: Evaluating evidence and author credibility, rejecting faulty reasoning Reading across the curriculum; asking the right questions to get the most out of reading in the natural sciences, social sciences & Humanities
Drawing Conclusions: putting it all together.

Teaching Methodology
- Lecturing

Assessment: Sessional (25%) Mid Term (25%) Final Term (50%)

Text & Reference books:
1. College Writing Skills with Readings, by John Langan, McGraw-Hill, 5th Edition.
2. A Textbook of English Prose and Structure by Arif Khattak, et al, GIKI Institute, 2000.

2nd Semester

SE-103 Discrete Structures

Prerequisite: None

Contact Hours:
Theory =48

Credit Hours:
Theory = 3.0

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** the basic concepts related to Discrete Structures	Cognitive	2	1
2.	***Solve*** problems using elementary set theory, logic, Venn diagrams, tree and graph theory.	Cognitive	3	3
3.	***Distinguish*** relations, functions and to solve counting problems.	Cognitive	4	2

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:
Introduction to logic and proofs: Direct proofs; proof by contradiction, Sets, Venn Diagram & its applications, Sequences and series, Formal logic, Prepositional and predicate calculus, Mathematical Induction and Recursion, loop, Relations and functions, Types of Function & Relations, Trees and Graphs, Paths & Circuits, euler graph, Hamiltonian path, Isomorphism's of graph, Spanning trees, Combinatorics: K-Permutation and K-Combination, K-Selection and K-Sampling, Inclusion Exclusion Principle, Probability, laws of probability, conditional probability, Random Variable.

Teaching Methodology
- Lecturing

Assessment
- **Sessional (25%)**
  - Quizzes
  - Assignments
- **Mid Term (25%)**
- **Final Term (50%)**

Text & Reference books:

1. Discrete Mathematics with Applications, By: Susanna S. Epp, Edition: 4th, Publisher: Cengage Learning, ISBN: 0495391328, Year of Publication: 2010.
2. Discrete Mathematics and Its Applications, By: Kenneth H. Rosen, Edition: 7th, Publisher: McGraw-Hill Science/Engineering/Math, ISBN: 0073383090, Year of Publication: 2011.
3. Discrete Mathematics, By: Richard Johnsonbaugh, Edition: 7th, Publisher: Pearson, ISBN: 0131593188, Year of Publication: 2007.
4. Discrete Mathematical Structures, By: Kolman, Busby & Ross, Edition: 6th, Publisher: Pearson, ISBN: 0132297515, Year of Publication: 2008.

SE-104 Object-Oriented Programming

Prerequisite: SE-102 Introduction to Programming

Contact Hours:
Theory =48

Credit Hours:
Theory = 3.0

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Understand*** principles of Object Oriented Programming paradigm.	Cognitive	2	1
2.	***Apply*** the object and their relationships to model & build object oriented solutions.	Cognitive	3	3
3.	***Examine*** an object oriented solution.	Cognitive	4	2

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:
Introduction to object oriented design, history and advantages of object oriented design, introduction to object oriented programming concepts, classes, objects, data encapsulation, constructors, destructors, access modifiers, const vs non-const functions, static data members & functions, function overloading, operator overloading, identification of classes and their relationships, inheritance, multiple inheritance, polymorphism, abstract classes, function & class templates, standard template library, object streams, data and object serialization using object streams, exception handling.

Teaching Methodology
- Lecturing

Assessment
- **Sessional (25%)**
  - Assignments
  - Quizzes
- **Mid Term (25%)**
- **Final Term (50%)**

Text & Reference books:
1. C++ How to Program, By: Harvey Deitel & Paul Deitel, Edition: 8th, Publisher: Prentice Hall, ISBN: 0136152503, Year of Publication: 2011.
2. Object Oriented Programming in C++ By: Robert Lafore, Edition: 4th , Publisher: SAMS Publishing, ISBN: 0672323087, Year of Publication: 2001.
3. Java How to Program, By: Harvey Deitel & Paul Deitel, Edition: 9th, Publisher: Prentice Hall, ISBN: 0132575663, Year of Publication: 2011.

SE-104L Object Oriented Programming Lab

Prerequisite: SE-102 Introduction to Programming

Contact Hours:
Lab =48

Credit Hours:
Lab = 1.0

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Solve*** problems by applying the concepts of data encapsulation, inheritance and polymorphism.	Psychomotor	3	3
2.	***Justify*** time and resource allocation to complete the assigned task.	Affective	3	11
3.	***Report*** the outcome of an experiment/task in standard format.	Affective	2	10
4.	***Demonstrate*** knowledge about the practical aspects of Introduction of Programming Lab Course.	Cognitive	2	1
5.	***Work*** effectively as an individual or in team to solve real world problems.	Affective	3	9

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☑
4	Investigation:	☐	10	Communication:	☑
5	Modern Tool Usage:	☐	11	Project Management:	☑
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

List of Experiments:

S#	Description
1.	Exploring Dev-C++ IDE
2.	Implementation of Classes & objects in C++
3.	Class constructor and destructor
4.	Constant and non-constant function
5.	Static data member and functions
6.	Function overloading and Operator overloading
7.	Unary & binary Operator Overloading
8.	Inheritance
9.	Virtual Functions
10.	Abstract classes
11.	Interfaces
12.	Streams and Files
13.	Function Templates and Class Templates
14.	Exception Handling
15.	Open Ended Lab

Teaching Methodology:

- Demonstration
- Lab Tasks
- Open Ended Lab

Assessment

- **Sessional (25%)**
- **Mid Term (25%)**
- **Final Term (25%)**
- **Viva Voce Examination (25%)**

Teaching Material: Object Oriented Programming, Lab Manual.

BSH-130 Applied Physics

Prerequisite: None

Contact Hours:
Theory =48

Credit Hours:
Theory = 3.0

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Refresh*** students' previous knowledge of the basic physical laws and introduce them with the techniques of calculations at the higher levels.	Cognitive	1	1
2.	***Train/guide*** students in the analytical studies of different physical phenomenon pertaining to wave creation/propagation and characteristics.	Cognitive	3	2

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

Scalar and Vector quantities, Vector Algebra, Rectangular and non-rectangular components, Product of vectors, Laws of motion, Law of gravitation, Projectile motion, Simple harmonic motion (SHM), Simple pendulum, torsion pendulum, compound pendulum, Damped Harmonic Oscillation, Forced Harmonic Oscillation, Types of Waves, Expression describing travelling waves, Differential wave equation, Wave speed in stretched string, Wave speed in fluids, Superposition principle, Interference, Young's double slit experiment, Standing waves (analytical treatment), Standing waves in stretched string, air columns. Beats (analytical proof), Doppler's Effect , Doppler's Effect in EM waves, Hydrogen spectrum, Bohr's atomic model, determining radii/energies of stable orbits in H-atom, Finite mass correction, EM spectrum, X-rays, X-rays production, properties, uses, Mosley Law, X-rays diffraction, X-rays spectrum, Mosley law, X-rays diffraction, Wave-particle duality, Photoelectric effect, De-Broglie wavelength, Electric current, Ohm's law (microscopic), resistance/resistivity, temperature co-efficient of resistivity, resistor combinations, Capacitor & capacitance, energy stored in a charged capacitor, combinations of capacitors, Capacitor with dielectric.

Teaching Methodology

- Lecturing

Assessment: Sessional (25%) Mid Term (25%) Final Term (50%)

Text & Reference books:

1. Sears and Zemansky's University Physics with modern Physics, 13th Edition, Authors; Young/Freedman Ford.
2. Fundamentals of Physics by Halliday, Resnic, Walker (6th Edition).
3. Physics by David Holliday & Resnick, College Physics, Pacific Physics for A Levels.

BSH-201 Communication & Presentation Skills

Prerequisite: None

Contact Hours:
Theory =48

Credit Hours:
Theory = 3.0

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Understand*** and recognize their communication problems and respond accordingly.	Affective	1	10
2.	***Accelerate*** in writing, listening, speaking and reading ,and work towards desired response..	Affective	3	10
3.	***Organize*** their thoughts, expressions and ideas in effective ethical communication and revise for perfection..	Affective	5	8
4.	***Recognize*** and comprehend organizational communication system for improved knowledge of technical writing skills needed professionally. Understanding of do's and don'ts of technical communication.	Cognitive	2	12

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☐	7	Environment and Sustainability:	☐
2	Problem Analysis:		8	Ethics:	☑
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☑
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☑

Course outline:
Principles of writing good English, understanding the composition process: writing clearly; words, sentence and paragraphs; Comprehension and expression; Use of grammar and punctuation. Process of writing, observing, audience collecting, composing, drafting and revising, persuasive writing, reading skills, listening skills and comprehension, skills for taking notes in class, skills for exams; Business communications; planning messages, writing concise but with impact. Letter formats, mechanics of business, letter writing, letters, memo and applications, summaries, proposals, writing resumes, styles and formats, oral communications, verbal and non-verbal communication, conducting meetings, small group communication, taking minutes. Presentation skills; presentation strategies, defining the objective, scope and audience of the presentation, material gathering material organization strategies, time management, opening and concluding, use of audio-visual aids, delivery and presentation.

Teaching Methodology
- Lecturing

Assessment
- **Sessional (25%)**
  - Assignments
  - Quizzes
- **Mid Term (25%)**
- **Final Term (50%)**

Text & Reference books:
1. Effective Business Communication by Herta A. Murphy, Herbert W. Hilderandt, 7th Edition
2. Practical English Grammar-Exercise 2, by A. J. Thomson and A.V. Martinet, 3rd Edition
3. Writing Upper-Intermediate – Oxford Supplementary Skills by Rob Nolasco, 4th Edition

3rd Semester

SE-202 Data Structures & Algorithms

Prerequisite: SE-104 Object Oriented Programming

Contact Hours:
Theory =48

Credit Hours:
Theory = 3.0

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1	***Relate*** procedural and/or OO Programming concepts for learning various data structures and associated algorithms	Cognitive	3	1
2	***Utilize*** Data Structures and standard algorithms for data manipulation, searching and sorting.	Cognitive	3	5
2	***Analyze*** simple algorithms for complexity in terms of time and space parameters.	Cognitive	4	2

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☑	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:
Abstract data types, complexity analysis, Big Oh 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, sorted linked list, searching an unsorted array, binary search for sorted arrays, hashing and indexing, 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, memory management and garbage collection.

Teaching Methodology
- Lecturing

Assessment
- **Sessional (25%)**
- **Mid Term (25%)**
- **Final Term (50%)**

Text & Reference books:
1. Data Structures and Algorithm Analysis, Mark Allen Weiss, Florida International University, Addison-Wesley (latest Edition)
2. Algorithms, Robert Sedgewick, Princeton University Publisher: Addison- Wesley Professional (latest Edition)
3. Data Structures: Abstraction and Design Using Java, Koffman and Wolfgang, Wiley; 2nd Edition (or latest Edition), 2010 22
4. Data Structures and Algorithms in C++, Adam Drozdek, Course Technology; 4th Edition, 2012.

SE-202L Data Structures & Algorithms Lab

Prerequisite: SE-104 Object Oriented Programming

Contact Hours:
Lab =48

Credit Hours:
Lab = **1.0**

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Demonstrate*** knowledge about the practical aspects of data structures & algorithms Lab Course.	Cognitive	3	1
2.	***Achieve*** the ability for developing Data structures & Algorithms based solutions that meet specified needs for an engineering problem at hand.	Psychomotor	4	3
3.	***Report*** an engineering task in the required format.	Affective	2	10
4.	***Justify*** time and resource allocation to complete the assigned task.	Affective	2	11
5.	***Work*** effectively as an individual or in team to solve real world problems.	Affective	3	9

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☑
4	Investigation:	☐	10	Communication:	☑
5	Modern Tool Usage:	☐	11	Project Management:	☑
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

List of Experiments:

S#	Description
1.	Data Structure & Algorithms using C++ and Exploring Eclipse IDE
2.	Reviewing arrays and pointers in C++
3.	Implementation of list using Link list
4.	Implementation of doubly linked list and circular linked list
5.	Stack implementation using arrays and Link List
6.	Queue implementation using arrays and link list
7.	Binary search tree (BST) operations such as insertion and traversal implementation using Linked list
8.	Binary Search tree (BST) operation such as deletion, searching, in-order, pre-order, post-order and level-order traversal implementation using Linked list
9.	AVL tree implementation that is insertion for single & double rotation in AVL tree
10.	AVL tree implementation that is deletion of a node in AVL tree
11.	Implementation of Graph traversal using Breadth-first-Search
12.	Implementation of Graph traversal using Depth-first-Search and implementation of Dijkstra's Algorithm
13.	Implementation of Elementary Sorting Algorithms (N2 Complexity) like selection, insertion and bubble sort
14.	Implementation of Divide and conquer sorting algorithm that is Merge Sort (N log2(N))
15.	Implementation of Greedy Algorithms and Huffman Encoding Algorithm
16.	Course Review for final term examination

Teaching Methodology

- Demonstration
- Lab Tasks

Assessment: Sessional (25%), Mid Term (25%), Final Term (25%), Viva Voce Examination (25%)

Teaching Material: Data Structures and Algorithms Lab Manual

SE-204 Introduction to Software Engineering

Prerequisite: None

Contact Hours:
Theory =48

Credit Hours:
Theory = 3.0

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Describe*** and apply the basic concepts of software engineering and workflow of software development process.	Cognitive	1	1
2.	***Develop*** small software design models.	Cognitive	3	3
3.	***Identify*** key principles and common methods for software project management such as scheduling, size estimation, cost estimation and risk analysis	Cognitive	3	2

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

Nature of Software, Overview of Software Engineering, Professional software development, Software engineering practice, Software process structure, Software process models, Agile software Development, Agile process models, Agile development techniques, Requirements engineering process, Functional and non-functional requirements, Context models, Interaction models, Structural models, behavioral models, Software testing and quality assurance, Software evolution, Project management and project planning, configuration management, Software Process improvement. Software verification and validation. Project Management. Risk Management; Maintenance and Reengineering.

Teaching Methodology

- Lecturing

Assessment

- **Sessional (25%)**
  - Assignments
  - Quizzes
- **Mid Term (25%)**
- **Final Term (50%)**

Text & Recommended books:

1. Software Engineering, Sommerville I., 10th Edition, Pearson Inc., 2014.
2. Software Engineering, A Practitioner's Approach, Pressman R. S.& Maxim B. R., 8th Edition, McGraw-Hill, 2015.

BSH-102 Pakistan Studies

Prerequisite: None

Contact Hours:
Theory =32

Credit Hours:
Theory = 2.0

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** difference between ideological and non-ideological state.	Cognitive	2	8
2.	***Discuss*** Pakistan Movement, political and constitutional history of Pakistan.	Cognitive	2	8
3.	***Discuss*** current issues of Pakistan, their causes and solution, Population Dynamics in Pakistan.	Cognitive	2	7
4.	***Describe*** important historical event, geographical demarcation and to state deep understanding about past events and future learning.	Cognitive	1	12

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☐	7	Environment and Sustainability:	☑
2	Problem Analysis:	☐	8	Ethics:	☑
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☑

Course Outline: Ideolgy, definition, importance, some kind of ideology, Pakistan ideology. Sayings of Quaid –I Azam ,Iqbal about Pakistan Ideology, Aims and objective of the creation of Pakistan, Reformist Movement in Subcontinent. Sheikh Ahmad Sirhindi, Shah Waliullah, Syyed Ahmad Shaheed Barilvi, Partition Of Bengal , Simla Deputation, Muslim League 1906, Lucknow Pact 1916 Nehro Report 1928, Quaid –i- Azam 14 Points, Round table conferences and Act of 1935, Congress Ministeries and Lahore Resolution 1940, 3rd June plan and Independance 1947, Constitution and Law, methods of making the constitution, Constitutional Assembly, Nature and Structure of Constitution , Objective Resolution 1949, Basic Principles Committee, Assassination of Liaqat Ali, Dissolution of the Cabinet of Khwaja Nazimuddin. M.Ali Bogra Formula 1954, and dissolution of the Constitutional Assembly, Decision of Sindh High Court and Supreme Court, "Doctrine of Necessity", Features of 1956, 1973 Constitutions, Ammendments in the Constitution (17th, 18th, 19th and 20th) Foreign Policy,Objectives. Determinants of Pakistan Foreign Policy, Population Dynamics in Pakistan.

Teaching Methodology: Lecturing

Assessment: Mid Term (25%), Final Term (50%), Sessional Marks (25%)

Text book:

1. The Emergence of Pakistan, Chaudary M., 1967
2. The making of Pakistan, Aziz. 1976
3. A Short History of Pakistan, I. H. Qureshi, ed., Karachi, 1988

BSH-142 Linear Algebra

Prerequisite: None

Contact Hours:
Theory =48

Credit Hours:
Theory = 3.0

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Demonstrate*** their competence with the ideas in linear algebra to work with linear systems and vector spaces.	Cognitive	1	1
2.	***Apply*** the knowledge of linear algebra to model and solve linear systems that appear in engineering sciences.	Cognitive	3	1
3.	***Apply*** the techniques of Gauss Elimination and Gauss Jordon for solving Homogeneous and Non-Homogeneous equations.	Cognitive	3	2
4.	***Use*** the vector space to describe the bases and dimension of different type problems and to solve different problems.	Cognitive	3	2

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:
Groups and Fields, Vector Spaces, Sub-Spaces, Matrices, Upper & Lower Triangular form, Echelon Form, Determinants, Co-factor and Inverse, Rank, Linear Independence, Solution of system of Linear systems, Gaussess Elimination Method, Gauses Gorden Method, Positive Definite matrix, Linear Transformations, Operations on matrices, Inner products, orthgonality and least squares, Eigenvalue & Eigenvectors. Applications to Systems of Equations and to Geometry, Singular Value Decomposition.

Teaching Methodology: Lecturing

Assessment

Sessional (25%)

Mid Term (25%)

Final Term (50%)

Text book:

1. Elementary Linear Algebra with Applications, By: Bernard Kolman, David Hill, Edition: 9th, Publisher: Prentice Hall PTR, ISBN: 0132296543, Year of Publication: 2007.
2. Linear Algebra And Its Applications, By: David C. Lay, Edition: 4th, Publisher: Pearson, ISBN: 0321385179, Year of Publication: 2011.
3. Elementary Linear Algebra, By: Howard Anton, Chris Rorres, Edition: 11th, Publisher: John Wiley & Sons, ISBN: 1118473507, Year of Publication: 2013.

BSH-110 Professional Practices

Prerequisite: None

Contact Hours:
Theory =48

Credit Hours:
Theory = **3.0**

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Defines*** the Engineering dimensions and problem solving approach ***and Produce*** a frame work for making reasonable moral choices and resolving moral dilemmas.	Cognitive	1	6
2.	***Develop*** the ability to manage confidentiality and fulfil the required responsibilities at a workplace.	Cognitive	3	8
3.	***Explain*** the impact of a sustainable engineering solution in societal and environmental context	Cognitive	2	7
4	***Evaluate*** and deal with issues related to computers and to counter moral threats to the right of privacy.	Cognitive	5	8

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☐	7	Environment and Sustainability:	☑
2	Problem Analysis:	☐	8	Ethics:	☑
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☑	12	Lifelong Learning:	☐

Course outline:

Computing Profession, Computing Ethics, Philosophy of Ethics. The Structure of Organizations, Finance and Accounting, Anatomy of a Software House, Computer Contracts, Intellectual Property Rights, The Framework of Employee Relations Law and Changing Management Practices, Human Resource Management and IT, Health and Safety at Work, Software Liability, Liability and Practice, Computer Misuse and the Criminal Law, Regulation and Control of Personal Information. Engineering Ecology, Sustainable Development, Technology Assessment, Overview of the British Computer Society Code of Conduct/Overview of PEC code of ethics and PEC code of conduct, IEEE Code of Ethics, ACM Code of Ethics and Professional Conduct, ACM/IEEE Software Engineering Code of Ethics and Professional Practice. Accountability and Auditing, Social Application of Ethics.

Teaching Methodology:

- Lecturing

Assessment: Sessional (25%) Mid Term (25%) Final Term (50%)

Text book:

- Introduction to Engineering Ethics, By Mike Martin and Roland Schinzinger, Edition: 2nd, Publisher: McGraw-Hill Science/Engineering/Math, ISBN-13:978-0072483116,Year of Publication: 2009.
- Ethics for the Information Age, By: Michael J. Quinn, 6th Edition, Publisher: Addision Wesely, ISBN: 978-0-13-285553-2, Year of Publication: 2014.

4th Semester

SE-207 Software Requirements Engineering

Prerequisite: SE-204 Introduction to Software Engineering

Contact Hours:
Theory =48

Credit Hours:
Theory = 3.0

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Understand*** fundamental concepts and activities of Requirements Engineering, Information elicitation techniques, Modeling scenarios.	Cognitive	1	1
2.	***Apply*** the techniques and tools required for requirements evaluation, selection, prioritization, management, traceability.	Cognitive	3	3
3.	***Evaluate*** effective requirements in Software Requirements Specification (SRS) using clear, unambiguous requirements.	Cognitive	5	4

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☑	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course Outline:
Introduction to Requirements Engineering, Software Requirements, classification of requirements, Requirements process, Levels/layers of requirements, Requirement characteristics, Analyzing quality requirements, Software requirements in the context of systems engineering, Requirement evolution, requirement traceability, requirement prioritization, trade-off analysis, risk analysis and impact analysis, Requirement management, interaction between requirement and architecture, Requirement elicitation, elicitation sources and techniques, Requirement specification and documentation, specification sources and techniques, Requirements validation and techniques, Management of Requirements, Introduction to Management, Requirements Management Problems , Managing Requirements in an Acquisition Organization, Supplier Organizations, Product Organizations, Requirements engineering for agile methods.

Teaching Methodology: Lecturing

Assessment: Sessional (25%), Mid Term (25%), Final Term (50%)

Text & Reference books:

1. Software Requirements, By: Karl E. Wiegers, Edition: 3rd , Publisher: Microsoft Press, ISBN: 0735679665, Year of Publication: 2013.
2. Requirements Engineering: Processes and Techniques, By: Gerald Kotonya and Sommerville, Edition: 1st, Publisher: John-Wiley & Sons, ISBN: 0471972088 , Year of Publication:1998 (or Latest Edition).
3. Software Requirements Specification, By: David Tuffley, CreateSpace, Edition: 1st , Publisher: Independent Publishing Platform, ISBN: 1453870229, Year of Publication: 2010.

SE-209 Introduction to Database Systems

Prerequisite: None

Contact Hours:
Theory =48

Credit Hours:
Theory = **3.0**

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

S. No.	CLO	Domain & Taxonomy level	PLO
1.	***Explain*** fundamental database concepts.	C-2	1
2.	***Design*** conceptual, logical and physical database schemas using relational data model.	C-3	3
3.	***Identify*** functional dependencies and resolve database anomalies by normalizing database tables.	C-3	3
4.	***Design & Experiment with*** databases using Structured Query Language (SQL) for database definition and manipulation.	C-3	3
5.	***Work*** effectively as an individual or in team to ***solve*** real world problems	A-3	9

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☑
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

Basic database concepts, Database approach vs file based system, database architecture, three level schema architecture, data independence, 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.

Teaching Methodology

- Lectures

Assessment

- **Sessional (25%)**
- **Mid Term (25%)**
- **Final Term (50%)**

Text & Reference books:

1. Modern Database Management by Jeffrey A. Hoffer, Ramesh Venkataraman and Heikki Topi, 10th Edition.
2. Fundamentals of Database System , 7th Edition, by Elmasri Ramez and Navathe Shamkant.
3. Database Systems: A Practical Approach to Design, Implementation, and Management, 6th Edition by Thomas Connolly and Carolyn Begg

SE-209L Introduction to Database System Lab

Prerequisite: None

Contact Hours:
Lab =48

Credit Hours:
Lab = **1.0**

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

S#	CLO	Domain & Taxonomy level	PLO
1.	***Justify*** time and resource allocation to complete the assigned task	A-2	11
2.	***Achieve*** the ability for developing solutions that meet specified needs for an engineering problem at hand	P-3	3
3.	***Report*** an engineering task in the required format	A-2	10
4.	***Demonstrate*** the learning of the concepts of Database system	C-3	3
5.	***Work*** effectively as an individual or in team to ***solve*** real world problems	A-3	9

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☐	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☑
4	Investigation:	☐	10	Communication:	☑
5	Modern Tool Usage:	☐	11	Project Management:	☑
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

List of Experiments:

Week #	Lab Experiment Description
1.	Introduction to MS Visio
2.	Entity Relationship Diagram (ERD):Notations for Entities and Attributes
3.	Entity Relationship Diagram (ERD):Notation of Relationships
4.	Enhanced Entity Relationship Diagram (EERD)
5.	Conversion of ERD to relational schema
6.	Conversion of EERD to relational schema
7.	Conversion of relational schema to physical schema
8.	Normalization
9.	**Midterm Examination**
10.	Introduction to SQL, Data Definition Language (DDL): Create, Drop, Alter, Truncate etc.
11.	Data Manipulation Language (DML) Part I: Insert, Select, Update, Delete.
12.	Data Manipulation Language (DML) Part II: Joins: Inner & Outer Joins, Natural Join.
13.	Data Manipulation Language (DML) Part III: Aggregate Function, Group by etc.
14.	Views and Triggers
15.	Sub Queries [Co-related & Non Co-related]
16.	Backup and recovery, indexes

Teaching Methodology

- Demonstration, Lab Tasks

Assessment

- **Sessional (25%), Mid Term (25%), Final Term (25%), Viva Voce Examination (25%)**

Teaching Material:

1. Lab Manual.

SE-304 Operating Systems

Prerequisite: None

Contact Hours:
Theory =48

Credit Hours:
Theory= **3.0**

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** the core functions (*i.e.* process management, scheduling, memory management, file management, disk management) and structure of operating system.	Cognitive	2	1
2.	***Analyze*** algorithms of the core functions of operating systems with respect to the performance issues.	Cognitive	4	2
3.	***Analyze*** concurrency problems in multi-processing/multi-thread operating systems ***and Evaluate*** different process co-coordinating solutions.	Cognitive	5	2

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:
Overview of the computer system and interrupts, operating systems basics, process description and control, system calls, threads, concurrency and synchronization, critical section, hardware support, semaphores, monitors, message passing, reader-writer problem, deadlock, detection and recovery from deadlocks, processor scheduling algorithms, memory management, swapping, contiguous memory allocation, segmentation & paging, virtual memory management, demand paging, thrashing, memory-mapped files, file systems, file concept, directory and disk structure, directory implementation, free space management, disk structure and scheduling, swap space management, system protection, virtual machines, introduction to operating system security.

Teaching Methodology
- Lecturing
- Written Assignments
- Quizzes

Assessment
- **Sessional (25%)**
  - Assignments
  - Quizzes
- **Mid Term (25%)**
- **Final Term (50%)**

Text & Reference books:

1. Operating Systems: Internal and Design Principles, By: William Stallings, Edition: 9th, Publisher: Pearson, ISBN: 0134670957, Year of Publication: 2017.
2. Operating Systems Concepts, By: Silberschatz A., Peterson, J.L., & Galvin P.C., Edition: 9th or later, Publisher: Wiley & Sons, ISBN: 1118063333, Year of Publication: 2012.
3. Modern Operating Systems, By: Andrew S. Tanenmaum & Herbert Bos, Edition: 4th or later, Publisher: Prentice Hall, ISBN: 013359162X, Year of Publication: 2014.

SE-304L Operating Systems Lab

Prerequisite: None.

Contact Hours:
Theory =48

Credit Hours:
Lab = **1.0**

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Implement*** the core functions of the operating systems.	Psychomotor	3	3
2.	***Justify*** time and resource allocation to complete the assigned task	Affective	3	11
3.	***Report*** the outcome of an experiment/task in standard format.	Affective	2	10
4.	***Demonstrate*** knowledge about the practical aspects of Operating System.	Cognitive	2	1
5.	***Work*** effectively as an individual or in team to ***solve*** real world problems	Affective	3	9

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☑
4	Investigation:	☐	10	Communication:	☑
5	Modern Tool Usage:	☐	11	Project Management:	☑
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

List of Experiments:

Lab 01 OS Administration-1: Installation of Linux Distribution (Ubuntu)
Lab 02 OS Administration-2: Exploring the Linux (Ubuntu) Environment
Lab 03 OS Administration-3: Essential Linux Commands
Lab 04 OS Administration-4: Process States In OS
Lab 05 Process Management-1: Process Creation
Lab 06 Process Management-2: Process Exit & Wait System Calls
Lab 07 Process Management-3: Creating and Managing Multiple/Orphan Processes
Lab 08 Process Scheduling-1: First Come First Serve (FCFS)
Lab 09 Process Scheduling-2: Shortest Job First
Lab 10 Process Scheduling-3: Round Robin
Lab 11 Mutual Exclusion using Semaphores
Lab 12 File I/O: Reading & Writing from/to a File
Lab 13 Inter-Process Communication Using Pipes
Lab 14 Memory Management

Teaching Methodology

- Demonstration
- Experiments

Assessment

- Sessional (25%)
- Mid Term (25%)
- Viva Voce (25%)
- Final Term (25%)

Teaching Material: Operating Systems Lab Manual.

BSH-341 Probability and Statistics

Prerequisite: None

Contact Hours:
Theory =48

Credit Hours:
Theory = 3.0

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Understand*** the basic concepts of probability, random variables, probability distribution, and joint probability distribution.	Cognitive	1	1
2.	***Use*** statistical methodology and tools in the engineering problem-solving process. Compute and interpret descriptive statistics using numerical and graphical techniques.	Cognitive	3	1
3.	***Compute*** point estimation of parameters, explain sampling distributions, and understand the central limit theorem.	Cognitive	3	2
4.	***Be able*** to visually presents the mathematical function.	Cognitive	2	2

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

Introduction to Statistics, Descriptive Statistics, Statistics in decision making, Graphical representation of Data Stem- and Lead plot, Box-Cox plots, measures of central tendencies and dispersion, moments of frequency distribution; Counting techniques, introduction to probability, sample space, events, laws of probability, Conditional probability and Baye's theorem with application to random variable (Discrete and continuous) Binomial, Poisson, Geometric, Negative Binomial Distributions; Exponential Gamma and Normal distributions, Expectation and variance of a random variable, PDF, PMF, Chebyshev's Theorem, Regression and Correlation, Estimation and testing of hypotheses, use of elementary statistical packages for explanatory Data analysis.

Teaching Methodology:

- Lecturing
- Written Assignments
- Quizzes

Assessment: Sessional (25%) Mid Term (25%) Final Term (50%)

Text book:

1. Probability & Statistics for Engineers & Scientists, By: Ronald Walpole, Myers, Myers, Ye, Edition: 9th, Publisher: Prentice Hall, ISBN: 0321629116, Year of Publication: 2011.
2. Probability and Statistics for Engineering and the Sciences, By: Lay L. Devore, Edition: 8th, Publisher: Cengage Learning, ISBN: 0538733527, Year of Publication: 2011.

5th Semester

SE-302 Software Design and Architecture

Prerequisite: SE-207 Software Requirement Engineering

Contact Hours:
Theory: 32

Credit Hours:
Theory: 02

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Understand*** the importance and roles of design and its major activities in software systems.	Cognitive	1	1
2.	***Comprehend*** the design challenges and solutions with associated trade-offs	Cognitive	2	2
3.	***Design*** models and refine them to reflect implementation details	Cognitive	6	3
4.	***Use*** modern tools to implement and ***evaluate*** a system's architecture using different techniques.	Cognitive	5	5

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☑	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:
Software Design Concepts, Design principles, Object-Oriented Design with UML, System design and software architecture, Object design, Mapping design to code, User interface design, Persistent layer design, Web applications design, State machine diagrams and modeling, Agile software engineering, Design Patterns, Exploring inheritance, Interactive systems with MVC architecture, Software reuse. Architectural design issues, Software Architecture, Architectural Structures & Styles-, Architectural Patterns, Architectural & Design Qualities, Quality Tactics, Architecture documentation, Architectural Evaluation, Model driven development.

Teaching Methodology
- Lecturing

Assessment
- **Sessional (25%)**
  - Assignments
  - Quizzes
  - Project Presentation
- **Mid Term (25%) and Final Term (50%)**

Text & Reference books:

1. Software Engineering: A Practitioner's Approach, Roger S. Pressman, Bruce R. Maxim, 8th Ed, McGraw-Hill Education, 2015.
2. Object-Oriented Analysis, Design and Implementation, Brahma Dathan, Sarnath Ramnath, 2nd Ed, Universities Press, India, 2014.
3. Software Modeling and Design: UML, Use Cases, Patterns, and Software Architectures, Hassan Gomaa, Cambridge University Press, 2011.
4. Head First Design Patterns, Eric Freeman, Elisabeth Freeman, Kathy Sierra and Bert Bates, O'Reilly Media, Inc. 2004.

SE-302L Software Design and Architecture Lab

Prerequisite: None

Contact Hours:
Theory: 48

Credit Hours:
Theory: 01

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Justify*** time and resource allocation to complete the assigned task**.**	Affective	3	11
2.	***Manipulates*** tools and techniques for software designing and documentation of software systems.	Psychomotor	4	3
3	***Report*** the outcome of an experiment/task in standard format.	Affective	3	10
4	***Demonstrate*** knowledge about the practical aspects of Software design and architecture lab course.	Cognitive	2	1

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☑
5	Modern Tool Usage:	☐	11	Project Management:	☑
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

List of Experiments:

Week#	Lab Content
1	Introduction and project definition
2	Software Requirements Specification
3	Introduction to UML and use case diagrams
4	System modeling ER
5	System modeling DFD
6	Flow of events
7	Activity diagram
8	OO analysis: discovering classes
9	Interaction diagrams: sequence diagrams
10	Interaction diagrams: collaboration diagrams showing client server architecture pattern
11	Software Design: software architecture and object- oriented design
12	Draw Model view control (MVC) pattern of any project using UML Diagrams **(open ended lab)**
13	State Transition Diagram
14	Component diagrams showing component based architecture pattern
15	Deployment diagrams
16	Software testing and documentation

Teaching Methodology

- Demonstration, Practical tasks, Feedback on Practical tasks

Assessment

- **Sessional (25%):** Lab Tasks + Project**, Mid Term (25%), Final Term (25%), Viva Voce (25%)**

Text book & Reference Material:

1. Software Architecture and Design Illuminated, Kai Qian, Xiang Fu, Lixin Tao, Chong-Wei Xu, Jorge L. Diaz-Herrera, Jones and Bartlett Publishers, 1st Edition, 2009 (or Latest Edition).
2. Lab Manual.

SE-305 Computer Communication & Networks

Prerequisite: None

Contact Hours:
Theory =48

Credit Hours:
Theory = 3.0

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** the key terminologies, technologies and responsibilities of each layer in computer networks.	Cognitive	2	1
2.	***Analyze*** the service model of each layer in the TCP/IP protocol stack with respect to the protocols/algorithms.	Cognitive	4	2
3.	***Evaluate*** the working and performance of key technologies, algorithms and protocols.	Cognitive	5	2

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:
Introduction to computer networks and the Internet, basic components of a computer network, service view of computer network, network layered architecture, protocols and standards, network delays, application layer protocols: HTTP, FTP, SMTP and DNS, socket programming, transport layer service model, UDP, TCP, reliable transmission, flow control, congestion control, network layer service model, IP header, addressing, packet switching, circuit switching, datagram forwarding, routing, data link layer functionalities, multiple access techniques, LAN technologies, wireless networks, MAC addressing.

Teaching Methodology
- Lecturing

Assessment
- **Sessional (25%) -** Assignments, Quizzes
- **Mid Term (25%)**
- **Final Term (50%)**

Text & Reference books:

1. Data and Computer Communication, By: William Stallings, Edition: 10th, Publisher: Prentice Hall, ISBN: 0133506487, Year of Publication: 2013.
2. Computer Networking: A Top-Down Approach, By: Kurose and Ross, Edition: 6th, Publisher: Pearson, ISBN: 0132856204, Year of Publication: 2012.
3. Introduction to Computer Networks, By: A. S. Tanenbaum and David J. Wetherhall, Edition: 5th, Publisher: Prentice Hall, ISBN: 0132126958, Year of Publication: 2010.

SE-305L Computer Communication & Networks Lab

Prerequisite: None

Contact Hours:
Lab =48

Credit Hours:
Lab = 1.0

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

S#	CLO	Domain	Taxonomy level	PLO
1.	***Demonstrate*** the skills to configure network systems and troubleshoot common networking issues using appropriate tools.	Psychomotor	3	5
2.	***Construct*** different networking scenarios for the ***analysis*** of protocols.	Psychomotor	3	3
3.	***Justify*** time and resource allocation to complete the assigned task	Affective	3	11
4.	***Report*** the outcome of an experiment/task in standard format.	Affective	2	10
5.	***Work*** effectively as an individual or in team to solve real world problems	Affective	3	9
6.	***Demonstrate*** knowledge about the practical aspects of Computer Networks and Internet	Cognitive	2	1

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☑
4	Investigation:	☐	10	Communication:	☑
5	Modern Tool Usage:	☑	11	Project Management:	☑
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

List of Experiments:

S #	Description
1.	Network Basic Commands: TCP/IP Configuration & Troubleshooting
2.	Cable construction: Straight and Cross-Over
3.	Building a Switched Based Network
4.	Introduction to Wireshark- Packet Analyzer
5.	Analysis of HTTP using Wireshark
6.	Introduction to Socket Programming
7.	UDP Socket Programming: Client and Server
8.	TCP Socket Programming: Client and Server
9.	Analysis of TCP traffic using Wireshark
10.	IP Addressing, Sub-netting and DHCP Server Configuration
11.	Basic Router Configuration and Password Operations
12.	Advanced Router Configuration
13.	Configuration of Routing Information Protocol (RIP) and an Internetwork
14.	Configuration of Open Shortest Path First (OSPF) Protocol and an Internetwork
15.	Design & Analysis of Star Topology Ethernet LAN in Network Simulator (e.g, NS-2/NS-3, Opnet)

Teaching Methodology

- Demonstration
- Lab Tasks
- Assignments/Open Ended Labs

Assessment

- **Sessional (25%)**
- **Mid Term (25%)**
- **Final Term (25%)**
- **Viva Voce Examination (25%)**

Teaching Material: Computer Communication and Networks Lab Manual.

BSH-301 Technical Writing

Prerequisite: None

Contact Hours:
Theory =48

Credit Hours:
Theory = 3.0

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Analyze*** their audience and adapt for them accordingly.	Affective	3	10
2.	***Employ*** the apt writing techniques for effectiveness.	Affective	4	10
3.	***Produce and present*** effective documents by incorporating the strategies for effective communication.	Affective	5	12

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☐	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☑
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☑

Course outline:
Words and Phrases: A brief history of words, Dictionary of Thesaurus, Elements of Style.
Sentence Construction: Introduction, Guidelines for Effectiveness.
Paragraph Development: Introduction, Central Components of a Paragraph, Length, Techniques for Paragraph Development.
The Art of Condensation: Introduction, Steps to Effective Précis Writing, Samples, Guidelines.
Reading Comprehension: Introduction, Purpose of Reading, Reading Rates, Reasons for Poor Comprehension, Improving Comprehension Skills, Techniques for Good, Comprehension, Worked Out Sample Passages.
Business Letters: Business letters, Memos, E-mails.
Reports: Introduction, Objectives, Characteristics of a Report, Types of Reports, The Importance of Reports, Formats, Prewriting, Structure of Reports, Writing the Report, Revising, Editing, and Proofreading, Samples Exercises.
Technical Proposals: Definition Purposes, Types, Characteristics, Elements of Structure, Style and Appearance, Evaluation.
Research Paper, Dissertation, and Thesis: Introduction to Research Paper, Dissertation, Thesis.

Teaching Methodology
- Lecturing
- Written Assignments
- Report Writing

Assessment
- **Mid Term (25%)**
- **Final Term (50%)**
- **Sessional (25%)**
  - Presentation
  - Assignments
  - Report Writing

Text & Reference books:
1. Technical Communication: Principles and Communication, Author: Meenakshi Raman and Sangeeta Sharma
2. Basic communication skills for Technology by Andrea J. Rutherford, ISBN 978-8177584073.

BSH-*** Environment & Sustainability

Prerequisite: None

Contact Hours:
Lab =32

Credit Hours:
Theory = 2.0

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO	Domain	Taxonomy Level	PLO
1.	***Explain*** the importance of Environmental Science and its relationship with various segments of society and sectors of development.	Cognitive	2	7
2.	***Be familiar*** with current national, regional and global challenges for sustainable development.	Cognitive	2	7
3.	***Evaluate*** international environmental laws against domestic laws.	Cognitive	5	7

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☐	7	Environment and Sustainability:	☑
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course Outline:
Basic principles: about convergence of ecology with economic and sociology to evolve as environmental science, its nature, history, scope and the contribution to society. Environmental aspects: physic-chemical, biological, socio-economic, socio-cultural, moral and ethical, and philosophical thinking. Environmental problems: local, regional and global level. Environmental challenges: Sustainability of resources for development: efficiency of energy and water resources, current and future trends in growth and resultant environmental pollution, poverty and resource depletion, development in industry, agriculture and urbanization.

Teaching Methodology
- Lecturing

Assessment
- **Sessional (25%)**
- **Mid Term (25%)**
- **Final Term (50%)**

Text & Reference Books:

1. Environmental Science: Earth as a Living Planet, Botkin, D.B & Keller, E.A. 9 th Ed. John Wiley & Sons, 2013.
2. Environmental Science: systems and solutions, McKinney, M.L., Schoch, R.M. & Yonavjak, L. 5th Ed. Jones & Bartlett Publishers, 2013
3. Environmental Science: Toward a Sustainable Future, Wright, R.T. & Nebel, B.J. 10th Ed. Pearson Educational, 2007.

6th Semester

SE-206 Software Construction & Development

Prerequisite: SE-302 Software Design & Architecture

Contact Hours:
Theory =32

Credit Hours:
Theory = 2.0

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** the principles of Software construction.	Cognitive	1	1
2.	***Apply*** patterns, frameworks and techniques for software Construction	Cognitive	3	3
3.	***Evaluate*** modern tools and techniques for software construction.	Cognitive	5	5

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☑	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:
Software Construction Fundamentals, Construction in Life Cycle Models, Software Construction Planning and Measurement, construction design, coding and testing, construction for reuse, construction quality and integration, API design and use, Object-Oriented Runtime Issues, Parameterization and Generics, Error Handling, Exception Handling, and Fault Tolerance, Executable Models, State-Based and Table-Driven Construction Techniques, Grammar-Based Input Processing, Construction Methods for Distributed Software, Platform Standards, Test-First Programming, Software Construction Tools-Development Environments, GUI Builders, Unit Testing Tools. Software configuration management, Lehman's Laws of evolution, Martin Fowler's refactoring concepts and their application to small projects. Apply Michael Feathers' "legacy code" concepts.

Teaching Methodology
- Lecturing

Assessment
- **Sessional (25%)**
  - Assignments
  - Quizzes
- **Mid Term (25%)**
- **Final Term (50%)**

Text & Reference books:

1. Code Complete, 2nd ed., S. McConnell, Microsoft Press, 2004.
2. Clean Code: A Handbook of Agile Software Craftsmanship, Robert C. Martin, Prentice Hall, 2008.
3. The Pragmatic Programmer: From Journeyman to Master, Andrew Hunt and David Thomas, Addison-Wesley Professional, 1999.
4. Working Effectively with Legacy Code, Michael C. Feathers. Pearson Education, Prentice-Hall, 2004.
5. Refactoring: Improving the Design of Existing Code, Martin Fowler, Addison-Wesley Professional. 1999.

SE-206L Software Construction & Development Lab

Prerequisite: SE-302 Software Design & Architecture

Contact Hours:
Lab =48

Credit Hours:
Lab = 1.0

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1	***Demonstrate*** knowledge about the practical aspects of Software Construction & Development Lab Course.	Cognitive	2	1
2	***Justify*** time and resource allocation to complete the assigned task.	Affective	3	11
3	***Report*** the outcome of an experiment/task in standard format.	Affective	3	10
4	***Manipulates*** code generation algorithms for the design of a software system using software engineering approach.	Psychomotor	4	3
5	***Work*** effectively as an individual or in team to solve real world problems.	Affective	3	9

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☑
4	Investigation:	☐	10	Communication:	☑
5	Modern Tool Usage:	☐	11	Project Management:	☑
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

List of Experiments:

S#	Description
1.	Introduction to UML
2.	To prepare Use Case Diagrams and sequence diagram by using Rational Rose.
3.	To prepare Class Diagram by using Rational Rose
4.	To prepare Activity Diagram of project
5.	To prepare Package Diagram of project
6.	Design by contract (preconditions, postconditions, assertions) Run-time error checking (assertions, exceptions)
7.	To prepare Time management (timelines, Gantt charts) of your project
8.	Decoupling of modules, Metaprogramming
9.	Synchronous vs. Asynchronous, Testing, Documentation
10.	Coding on auto-pilot, Analysis of algorithms (time and space complexity), Refactoring, Testing (once again)
11.	Write a program to implement a symbol table.
12.	Write a program to develop a lexical analyzer to recognize a few patterns in the language program is written.
13.	Implement a lexical analyzer for a given language and the lexical analyzer should ignore redundant spaces, tabs and new lines.
14.	Implementation of lexical analyzer using LEX tool
15.	Write a program for constructing of LL (1) parsing.
16.	Project Consultation

Teaching Methodology

- Demonstration
- Lab Tasks
- Assignments

Assessment

- **Sessional (25%), Mid Term (25%), Final Term (25%), Viva Voce Examination (25%)**

Teaching Material: Lab Manual

SE-307 Software Quality Engineering

Prerequisite: SE-204 Introduction to Software Engineering

Contact Hours:
Theory =48

Credit Hours:
Theory = **3.0**

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Illustrate*** software testing and software quality assurance principles, processes and frameworks	Cognitive	2	1
2.	***Construct*** test case and test suites for completely testing different aspects of a software system.	Cognitive	3	3
3.	***Evaluate*** software testing techniques which are relevant for a particular case and know software reliability analysis tools and techniques	Cognitive	5	5
4.	***Work*** effectively as an individual or in team to solve real world problems.	Affective	4	9

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☑
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☑	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:
Software Quality, Software Quality Attributes, Quality Engineering., Testing: Concepts, Issues, and Techniques, Software testing lifecycle., Testing Scopes., Testing Approaches., Testing Concepts., Test Planning Process, Introduction to testing process, Requirement of software test planning, Testing documentation, Reporting and historical data recording., Software testing techniques, Testing philosophies , Testing strategies, Model based testing, Software testing techniques, Testing using models, Domain and combinatorial testing, Unit and integration testing, Acceptance testing, Test automation, Slicing, Software reliability models and engineering, Introduction, Exponential model., Reliability growth models, Modeling process, Software inspections, Software reviews, Inspection checks and metrics, Quality Models, Models for quality assessment, Product quality metrics, Quality Measurements, In-Process metrics for software testing, In-Process quality management, Effort/outcome models, System testing, Introduction to sub-system testing, From functional to system aspects of testing, System testing, Introduction to system testing, Scenarios development, System testing, Use-cases for testing, Specification-based testing, Open issues on software testing

Teaching Methodology

- Lecturing

Assessment
Sessional (25%)-Assignments**,** Quizzes, **Mid Term (25%), Final Term (50%).**

Text & Reference books:

1. The Art of Software Testing, By: Glenford J. Myers, Edition: 3rd , Publisher: Wiley, ISBN: 1118031962, Year of Publication: 2011.
2. Software Quality: Analysis and Guidelines for Success , By: Capers Jones, Edition: 2nd, Publisher: International Thomson Computer Press, ISBN: 978-1850328674, Year of Publication: 2000.
3. Fundamentals of Software Testing, By: Bernard Hom, Edition: 1st, Publisher: Wiley, ISBN: 1848213247, Year of Publication: 2012.
4. Software Quality Assurance: Principles and Practice, By: Nina S. Godbole, Edition: 2nd, Publisher: Alpha Science Series, ISBN: 184265702X, Year of Publication: 2014.

Software Quality Engineering: Testing, Quality Assurance, and Quantifiable Improvement, By: Jeff Tian, Edition: 1st , Publisher: John-Wiley & sons, ISBN: 0471713457 , Year of Publication: 2005.

SE-327 Information Security

Prerequisite: None

Contact Hours:
Theory =48

Credit Hours:
Theory = **3.0**

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** key concepts of information security such as design principles, cryptography, risk management, and ethics	Cognitive	2	1
3.	***Apply*** various security and risk management tools for achieving information security and privacy.	Cognitive	3	5
3.	***Identify & Evaluate*** appropriate techniques to tackle and solve problems in the discipline of information security.	Cognitive	4	3
4.	***Work*** effectively as an individual or in team to solve real world problems	Cognitive	3	9

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☑
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☑	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:
Information security foundations, security design principles; security mechanisms, symmetric and asymmetric cryptography, encryption, hash functions, digital signatures, key management, authentication and access control; software security, vulnerabilities and protections, malware, database security; network security, firewalls, intrusion detection; security policies, policy formation and enforcement, risk assessment, cybercrime law in information security, privacy and anonymity of data. Design an effective solution for a real time problems related to information security.

Teaching Methodology
- Lecturing

Assessment
Sessional (25%): Assignments, Quizzes
Mid Term (25%)
Final Term (50%)

Text book:

1. Computer Security: Principles and Practice, 3rd edition by William Stallings
2. Principles of Information Security, 6th edition by M. Whitman and H. Mattord
3. Computer Security, 3rd edition by Dieter Gollmann
4. Computer Security Fundamentals, 3rd edition by William Easttom
5. Official (ISC)2 Guide to the CISSP CBK, 3rd edition

SE-301 Web Engineering

Prerequisite: None

Contact Hours:
Theory =48

Credit Hours:
Theory= 3.0

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO	Domain & Taxonomy level	PLO
1.	***Produce*** static and responsive designs for web application.	C-3	3
2.	***Develop*** dynamic web application.	C-6	3
3.	***Apply*** techniques to resolve security threats in web applications.	C-3	3
4.	***Apply*** web standards for web application development.	C-3	3

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☐	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:
Web programming languages (e.g., HTML5, CSS 3, Java Script, PHP/JSP/ASP.Net), Design principles of Web based applications, Web platform constraints, Software as a Service (SaaS), Web standards, Responsive Web Design, Web Applications, Browser/Server Communication, Cookies and Sessions, Input Validation, Full stack state management, Web Domain and Hosting, Web App Security, Browser Isolation, Network Attacks, Session Attacks, Performance of Web Applications, Data Centers, Web Testing and Web Maintenance. Web standards.

Teaching Methodology
- Lecturing

Assessment
- **Sessional (25%)**
  - Assignments
  - Quizzes
- **Mid Term (25%)**
- **Final Term (50%)**

Text & Reference books:

1. Web Engineering, Rajiv Chopra, Prentice-Hall of India, 2016
2. Web Engineering, Emilia Mendes and Nile Mosley, Springer Verlag, 2010.
3. Web Engineering: A Practitioners' Approach, Roger S. Pressman, McGraw Hill, 2008.
4. Dynamic HTML: The Definitive Reference: A Comprehensive Resource for XHTML,
5. CSS, DOM, JavaScript 3rd Edition, O'Reilly Media 2007.
6. JavaScript: The Definitive Guide, 8th Edition, David Flanagan. O'Reilly Media. 2014.

SE-301L Web Engineering Lab

Prerequisite: None

Contact Hours:
Lab =48

Credit Hours:
Lab = 1.0

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	Achieve the ability for ***design/develop*** solutions that meet specified needs for a web engineering problem at hand.	Psychomotor	4	3
2.	***Justify*** time and resource allocation to complete the assigned task	Affective	3	11
3.	***Report*** an engineering task in the required format.	Affective	2	10
4.	***Demonstrate*** knowledge about the practical aspects of Web Engineering Lab Course	Cognitive	2	1
5.	***Work*** effectively as an individual or in team to solve real world problems.	Affective	3	9

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☑
4	Investigation:	☐	10	Communication:	☑
5	Modern Tool Usage:	☐	11	Project Management:	☑
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

List of Experiments:

Week #	Lab Experiment Description
1.	HTML Text Formatting Tags, Tables, Forms and Controls, Classes & IDs, HTML5 elements
2.	Cascading Style Sheets, selectors, styling borders, margins and padding, floating elements with CSS,
3.	JavaScript variables, operators, arrays, loop, functions, objects, events, form validation & debugging
4.	BootStrap framework, grid system, typography, tables, form, navbar, dropdown, images
5.	Programming constructs in PHP (syntax, variables, arrays, loops, functions)
6.	Connectivity with Database Server (database connection, CRUD operation, file upload)
7.	Session maintenance in HTTP
8.	AJAX (Asynchronous JavaScript & XML)
9.	Installation of Laravel PHP Framework, artisan commands
10.	Routing, Controllers, Blade templates (views)
11.	Middleware, Migrations, Models, exploring Auth Scaffolding, Eloquent ORM and relations, Form
12.	File uploading to a web server using FTP
13.	Vue framework, Vue instance, data and methods in vue instance, lifecycle hooks, directives, form
14.	Angular JavaScript Framework, syntax, module, controllers, expressions, directives, working with
15.	Installation of Wordpress, dashboard review,

Teaching Methodology

- Demonstration
- Lab Tasks
- Open Ended Lab

Assessment

- **Sessional (25%), Mid Term (25%), Final Term (25%), Viva Voce Examination (25%)**

Teaching Material:

2. Lab Manual.

7th Semester

SE-401 Human Computer Interaction

Contact Hours:
Theory =48

Credit Hours:
Theory = **3.0**

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Understand*** fundamental concepts of computer components function regarding interaction with human and vice versa.	Cognitive	2	1
2.	***Analyze*** interface problems to recognize what design approach and interaction styles is required in the light of usability standards and guidelines.	Cognitive	2	2

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:
Introduction, Goals and evolution, Cognitive framework and process, Human input-output channels, Computer devices, Design principles, Interaction framework and styles, HCI process and methodologies, Requirement, Evaluation, User, Information retrieval, Emerging paradigms.

Teaching Methodology

- Lecturing

Assessment

Sessional (25%)
- Assignments
- Quizzes

Mid Term (25%)
Final Term (50%)

Text book:
1. Human Computer Interaction by Alan Dix,3nd Edition, Prentice Hall 2004
2. Designing the User Interface: Strategies for effective Human Computer Interaction by Ben Shneiderman and Catherine Plaisant ,6th edition
3. Designing Interactive System: A comprehensive guide to HCI, UX and Interaction Design, Benyon, D.3rd edition, Pearson 2013.

SE-402 Software Project Management

Prerequisite: SE-204 Introduction to Software Engineering

Contact Hours:
Theory =48

Credit Hours:
Theory = 3.0

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** principles of the project lifecycle and how to identify opportunities to work with learners on relevant and appropriate project scenarios to share this understanding.	Cognitive	2	1
2.	***Critically*** evaluate and discuss the issues around project management and its application in the real world with course participants and learners.	Cognitive	5	11
3.	***Choose*** project management techniques for IT projects to initiate, plan, execute and evaluate a project and work in teams to create a project plan for a project scenario that includes key tasks, critical path, dependencies and a realistic timeline.	Cognitive	3	9
4.	***Present*** strategies for gaining confidence in managing projects through simple project planning examples.	Cognitive	5	11

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☑
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☑
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:
Introduction to Software Project Management, Project Management concepts, Project Management Tools, PMI 's Knowledge areas, PMI Framework, PMI Process Groups. Understanding Organizations. Project Planning, Project Evaluation, Selection of an Appropriate SDLC Approach in Project, Software Size Estimation, Activity Planning, Risk Management, Project Scheduling, Risk Control, Configuration Management, Change Control Process, Resource Allocation, Monitoring & Control, Software Project Scheduling, Software Quality Management Challenges of Outsourcing in Project Management.

Teaching Methodology
- Lecturing

Assessment
- **Sessional (25%):** Assignments**,** Quizzes
- **Mid Term (25%)**
- **Final Term (50%)**

Text & Reference books:
1. Software Project Management, Bob Hughes and Mike Cotterell, McGraw-Hill Education; 5th Edition (2009).
2. A Guide to the Project Management Body of Knowledge, 5th Edition (PMBOK Guides)
3. Mastering Software Project Management: Best Practices, Tools and Techniques, Murali K. Chemuturi and Thomas M. Cagley Jr., J. Ross Publishing, 2010
4. Effective Project Management: Traditional, Agile, Extreme, Robert K. Wysocki, Wiley; 6th Edition, 2011
5. Software Engineering: A Practitioner's Approach, Roger S. Pressman; 8th Edition.

SE-309 Entrepreneurship

Contact Hours:
Theory =32

Credit Hours:
Theory = **2.0**

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** the core concepts and basic theories of entrepreneurship	Cognitive	2	1
2.	***Design*** an appropriate business plan and select suitable business model	Cognitive	6	3
3.	**Explain** the impact of a sustainable engineering solution in societal and environmental context	Cognitive	2	7

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☑
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:
The nature and importance of entrepreneurship, the entrepreneurial decision process, types of start-ups and sustainability models. Entrepreneurial process, Managerial versus entrepreneurial decision making, Corporate versus entrepreneurial culture, Entrepreneurial leadership characteristics, Entrepreneurial feelings, Entrepreneurial background and characteristics, Role models and support systems, The nature of international entrepreneurship, Direct foreign investment, Barriers to international trade, Entrepreneurial partnering, Sources of new ideas, Market surveys, Methods of generating new ideas, sustainability of new idea, Product planning and development process, E-commerce and business start-up, business growth and its impact on environment, intellectual property, how to select a lawyer, legal issues for the entrepreneur, creating and starting the venture, business plan, The marketing plan, The organizational plan, the financial plan: operating and capital budgets, Pro forma sources and uses of funds, Bank lending decisions, Sources of capital, Capital sources in Pakistan, preparing for the new venture launch, New venture expansion strategies and issues, Acquisitions, Mergers, Entrepreneurship & Pakistan.

Teaching Methodology
- Lecturing

Assessment

Sessional (25%)
- Assignments
- Quizzes

Mid Term (25%)
Final Term (50%)
Text book:
1. Entrepreneurship by Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd (7th Edition).

SE-405 Final Year Project

Counseling Hours: 96 Hours **Credit Hours: 6.0**

FYP LEARNING OUTCOMES:

Upon successful completion of the Final Year Project, the student will be able to:

S#	CLOs Statement	Domain, TL	PLO
1	**Demonstrate** the ability to apply engineering knowledge to undertake complex engineering activity.	C2	1
2	**Break down** the development of an engineering product, system or concept.	P4	2
3.	**Apply** relevant engineering principles and techniques to design, operate, and simulate the development of an engineering product, system or concept.	P6	3
4	**Prioritize** the collected data and analyze result in order to make relevant decision on the performance of an engineering product, system or concept.	P5	4
5.	**Use** modern equipment and tools for investigating and presenting solutions to complex engineering problems/project.	P2	5
6.	**Explains the propose** engineering solutions to the identified problem for the betterment of Society/humankinds.	A3	6
7.	**Reports** the impact of engineering solutions in environmental context and present the need for sustainable development.	A2	7
8.	**Practice** ethical and professional norms for the implementation of engineering projects.	A2	8
9.	**Choose** project management techniques for project to work in a team to create a project plan for a project scenario.	A3	9
10.	**Relate and defend** development of solutions effectively through written and oral mode with the aid of multimedia tools.	A4	10
11.	**Choose** project management techniques for project to initiate, plan, execute and evaluate a project.	A5	11
12.	Show Motivation for **acquiring** extra technical knowledge in order to solve real life problems.	P2	12

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☑
2	Problem Analysis:	☑	8	Ethics:	☑
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☑
4	Investigation:	☑	10	Communication:	☑
5	Modern Tool Usage:	☑	11	Project Management:	☑
6	The Engineer and Society:	☑	12	Lifelong Learning:	☑

Course Synopsis: This course requires the implementation of the engineering knowledge learnt in the theoretical and practical classes. The final year projects involve planning, designing, experimental investigation, simulation, computer based study, literature review, and development where applicable in order to achieve the objectives. At different stages of Final Year Project, the students are to present his/her progress at a seminar.

Assessment Method

Chairman (15%), Supervisor (15%), Form 1: External (15%) (Combine Rubrics)
Supervisor (25%) (Separate Rubrics)
FYP (Committee) Progress Presentations (20%)

8th Semester

SE-410 Software Re-Engineering

Prerequisite: SE-206 Software Construction & Development

Contact Hours:
Theory =48

Credit Hours:
Theory = 3.0

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** the concepts and technique of software re-engineering.	Cognitive	2	1
2.	***Analyze*** and understand maintenance related problems associated with object oriented software systems.	Cognitive	4	2
3.	Able to perform complex ***design*** reengineering and reverse engineering problems.	Cognitive	5	3

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:
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.

Teaching Methodology
- Lecturing

Assessment
- **Sessional (25%)**
  - Assignments
  - Quizzes
- **Mid Term (25%)**
- **Final Term (50%)**

Text & Reference books:

1. Re-engineering legacy software, David Lorge Parnas, Chris Birchall, Safari Books, Shelter Island, NY, 2016
2. Reengineering, Priyadarshi Tripathy and Kshirasagar Naik, John Wiley & Sons, Inc.2015
3. Software Maintenance and Evolution: a Roadmap, K.H.Bennett and V.T Rajlich, The Future of Software Engineering, ACM Press 2000.

7. Contents of Software Engineering Elective Courses

SE-*** Agent Based Software Engineering

Contact Hours:
Theory =48

Credit Hours:
Theory = 3.0

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** the agent system terminology and development process of agent-based systems.	Cognitive	2	1
2.	***Illustrate*** the techniques to design agent-based system.	Cognitive	2	3
3.	***Modify*** architecture of the current software systems and restructure them to be agent-based	Cognitive	6	3

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:
Overview of agent-based software engineering. Methodologies for agent-based modeling, analysis and design: Agent-based Unified Modeling Language (AUML), Alternate agent-based analysis and design methods. Agent communication and knowledge sharing: knowledge level communication among software agents, Knowledge Interchange Format (KIF), Agent-based System Architecture and Organization. FIPA: Foundation for Intelligent Physical Agents: FIPA specification, the application, abstract architecture, agent management and agent message transport standards and guidelines.

Teaching Methodology
- Lecturing

Assessment
Sessional (25%)
Mid Term (25%)
Final Term (50%)

Text & Reference books:

1. Multi-agent Systems: A Modern Approach to Distributed Artificial Intelligence, Gerhard Weiss, Edt.,1st edition, MIT Press, 2000.
2. Agent-Oriented Methodologies, Paolo Giorgini, Idea Group Publishing, 2005.
3. Agent-Oriented Software Engineering III, Fausto Giunchiglia, James J. Odell, Gerhard Weiss, Springer Verlog - LNCS 2585 – 2002.

SE-*** Big Data Analytics

Prerequisites: Probability and Statistics, Introduction to Programming.

Contact Hours:
Theory =48

Credit Hours:
Theory = 3

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Provide*** fundamental information to get insight into the challenges with big data.	Cognitive	1	1
2.	***Understand*** techniques for storing and processing large amounts of structured and unstructured data	Cognitive	2	1
3.	***Application*** of big data concepts to get valuable information on market trends	Cognitive	3	3
4.	***Select*** a suitable technique and implement a sample project for extracting useful information from a mid sized dataset.	Cognitive	5	4

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☑	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:
Introduction to Big Data Analytics, Big Data Platforms, Data Store & Processing using Hadoop, Big Data Storage and Analytics, Big Data Analytics ML Algorithms, Recommendation, Clustering, and Classification, Linked Big Data: Graph Computing and Graph Analytics, Graphical Models and Bayesian Networks, Big Data Visualization, Cognitive Mobile Analytics.

Teaching Methodology
- Lecturing

Assessment
Sessional (25%)
- Assignments/Projects
- Quizzes

Mid Term (25%)
Final Term (50%)

Text & Reference books:
1. Mining of Massive Datasets, Jure Leskovec, Anand Rajaraman, Jeff Ullman, 2nd edition, 2011
2. Hadoop: The Definitive Guide, Tom White, 4th edition. 2009.
3. Data-Intensive Text Processing with Map Reduce, Jimmy Lin and Chris, 2010.

SE-*** Cloud Computing

Contact Hours:
Theory =48

Credit Hours:
Theory = 3.0

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** the core issues of cloud computing such as security, privacy, consistency and interoperability.	Cognitive	2	1
2.	***Develop*** and deploy cloud application using popular cloud platforms	Cognitive	2	5
3.	***Compare*** the key trade-offs between multiple design approaches used for cloud systems.	Cognitive	5	3
4.	***Write*** a comprehensive case study analyzing different cloud computing solutions	Cognitive	4	10

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☑
5	Modern Tool Usage:	☑	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:
Datacenter Architectures, Cloud Stack , Technology Trends, Consistency, Availability, Partitions, Cluster File Systems, Data-flow Computation Frameworks, Key-Value Store and Interactive Query Systems, Big Data in the Clouds, Geographic distributed Storage, Programming Languages for the Cloud, DBases in the Cloud, In-Memory Frameworks, Google file system, Hadoop file system, MapReduce, OSes and Clouds Networking: topologies, Networking: Traffic Management, Networking: Transport Protocol Improvements, Security, Scheduling and Resource Management in clouds, Software Level Agreements.

Teaching Methodology
- Lecturing

Assessment
Sessional (25%)
- Assignments
- Quizzes

Mid Term (25%)
Final Term (50%)

Text & Reference books:

1. Handbook of Cloud Computing, Borko Furht. Springer (2010) or Latest Edition
2. Cloud Computing: SaaS, PaaS, IaaS, Virtualization, Business Models, Mobile, Security, and More, Kris Jamsa Jones & Bartlett Publishers, (2012) or Latest Edition
3. Cloud Computing and SOA: Convergence in your enterprise, David Linthicum, (2009), Addison Wesley (Latest Edition)
4. Distributed File Systems: Hadoop, Lustre, Google File System, Andrew File System, Off system, Distributed File System", Ceph. General books LLC. (2010) or Latest Edition
5. Map Reduce Design Patterns, Donald Miner and Adam Shook. O' Reilly and Sons, (2012) or Latest Edition.

SE-*** Computer Graphics

Contact Hours:
Theory =48

Credit Hours:
Theory = **3.0**

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** the structure and function of display devices and Computer Graphic Fundamentals.	Cognitive	2	1
2.	***Compare*** key algorithms for modelling and rendering graphical data	Cognitive	4	4
3.	***Develop*** applications of computer graphics	Cognitive	6	3

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☑	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:
Fundamental Concepts: forward and backward rendering (i.e., ray-casting and rasterization), applications of computer graphics: including game engines, cad, visualization, virtual reality, polygonal representation, basic radiometry, similar triangles, and projection model, use of standard graphics APIs (see HCI GUI construction); basic rendering: rendering in nature, i.e., the emission and scattering of light and its relation to numerical integration, affine and coordinate system transformations, ray tracing, visibility and occlusion, including solutions to this problem such as depth buffering, painter's algorithm, and ray tracing, the forward and backward rendering equation, simple triangle rasterization, rendering with a shader-based API, texture mapping, including minification and magnification (e.g., trilinear MIP-mapping), application of spatial data structures to rendering, sampling and anti-aliasing, scene graphs and the graphics pipeline; geometric modeling: basic geometric operations such as intersection calculation, proximity tests, polynomial curves and surfaces, approximation techniques such as polynomial curves, bezier curves, spline curves and surfaces, animation as a sequence of still images.

Teaching Methodology
- Lecturing

Assessment
Sessional (25%)
Mid Term (25%)
Final Term (50%)

Text book:

1. Computer Graphics Using Open GL, By: Francis S. Hill, Jr., Edition: 3rd, Publisher: Prentice Hall, ISBN: 0131496700, Year of Publication: 2006.
2. Fundamentals of Computer Graphics: By Peter Shirley, Michael Ashikhmin and Steve Marschner , 3rd Edition, Publisher: CRC Press, ISBN: 1568814690, Year of Publication:2009.

SE-*** E-Commerce

Contact Hours:
Theory =48

Credit Hours:
Theory = 3.0

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO	Domain & Taxonomy level	PLO
1.	***Explain*** the concepts and standards related to the discipline of E-Commerce.	C-2	1
2.	***Analyze*** the existing payment procedures for given business scenarios	C-4	4
3.	***Develop*** solutions for complex real world problems found in Ecommerce.	C-6	3

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☑	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:
An overview of E-Commerce & its business models and concepts, planning an E-Commerce Framework, Managing Products and Categories, Product Variations and User Uploads, Enhancing the User Experience, The Shopping Basket, The Checkout and Order Process, Shipping and Tax, Discounts, Vouchers, and Referrals, Checkout, Taking Payment for Orders, User Account Management, Administration: Dashboard, Managing Products and Categories, Managing Orders, Customers, Refunds, Voucher Codes, Shipping, Deploying, Security, and Maintenance, Web Payment Systems, Social, Legal, and Ethical Issues of E-Commerce, Auctions, Portals, and Communities, SEO.

Teaching Methodology: Lecturing

Assessment
Sessional (25%): Assignments, Quizzes
Mid Term (25%)
Final Term (50%)

Text & Reference books:

1. E-Commerce, Kenneth Laudon and Carol Guercio Traver, 13th Edition, Pearson, 2017.
2. PHP 5 E-commerce Development, Michael Peacock, Packt Publishing, 2010.
3. Introduction to E-Commerce, Jeffrey F. Rayport, McGraw-Hill, 2nd Edition, 2007.
4. Electronic Commerce, Gary Schneider, Course Technology; 12th Edition 2016

SE-*** Global Software Development

Contact Hours:
Theory =48

Credit Hours:
Theory = 3.0

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Understand*** the principles of the software engineering in context of global software development.	Cognitive	2	1
2.	***Evaluate*** and discuss the issues around global software development and techniques for managing distributed projects.	Cognitive	4	2
3.	***Understand*** Configuration management systems, release management and task assignments in context of distributed projects.	Cognitive	2	1
4.	***Acquire*** strategies for effectively dividing tasks among teams, controlling the communication among teams, planning tasks and collaborating on modular project with the help of realistic examples.	Cognitive	3	9

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☑
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:
Introduction to Global Software Development. Global Teams and Organization. Guideline for making the virtual team. The Geography of Coordination. Dealing with Distance. Architectures and Coordination: Reconfiguration of Existing Product Technologies, Identification of Coordination Requirements. Distributed Development Environments: Software configuration management, Awareness among Configuration Management. Challenges of Culture: Managing distances and differences in geographically distributed work groups. The Outsourcing Relationship. Facilitating Cross-site Trust, Cooperation, and Social Capital: Communication and Trust in Global Virtual Teams. Social Networks and Knowledge Networks. Communication and Awareness: dealing with distance. Assessing Coordination Risk.

Teaching Methodology
- Lecturing

Assessment
Sessional (25%)
- Assignments
- Quizzes

Mid Term (25%)
Final Term (50%)

Text & Reference books:
1. Global Software and IT: A Guide to Distributed Development, Projects", Christof Ebert, Wiley 2011.
2. Global Software Teams: Collaborating Across Borders and Time Zones", Erran Carmel.rentice Hall, 1999.

SE-*** Information System Audit

Contact Hours:
Theory =48

Credit Hours:
Theory = 3.0

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Understand*** the concepts and standards related to the discipline of Information System Audit.	Cognitive	1	1
2.	***Analyze*** and Audit Information Systems.	Cognitive	4	4

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☑	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:
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.

Teaching Methodology
- Lecturing

Assessment
Sessional (25%)
- Assignments
- Quizzes

Mid Term (25%)
Final Term (50%)

Text & Reference books:

1. Auditing Information Systems: Enhancing Performance of the Enterprise, Abraham Nyirongo, Trafford, 2015.
2. Information Systems Control and Audit, Ron Weber, Dorling Kindesley Pearson Education, 2014.
3. CISA® Certified Information Systems Auditor All-in-One Exam Guide, Peter Gregory, 3rd Edition, McGraw-Hill Education, 2016.

SE-*** Management Information System

Contact Hours:
Theory =48

Credit Hours:
Theory = 3.0

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Define*** concept of information technology management	Cognitive	1	1
2.	***Apply*** decision making approach to solve common business problem	Cognitive	3	3
3.	***Prepare*** effective solutions to business problems, and design a database application to solve a business problem.	Cognitive	3	3

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course Contents:
Introduction to Information Systems in Organizations; Business Process and Decision Making; Productivity, Innovation and Strategy; Database and Content Management; Decision Making and Business Intelligence; Competitive Advantage and Business Processes; Networks and Collaboration; ERP and E-commerce, Social Networking, and Web 3.0; Acquiring Information Systems Through Projects; Structure, Governance, and Ethics; Managing Information Security and Privacy

Teaching Methodology
- Lecturing

Assessment
Sessional (25%)
- Assignments
- Quizzes

Mid Term (25%)
Final Term (50%)

Text & Reference books:
1. Experiencing MIS, D. M. Kroenke, A. Gemino and P. Tingling. P. 4th Edition. Toronto: Pearson.2016.
2. Business driven information systems, P. Baltzan, B. Detlor, and C. Welsh, 4th Ed., McGraw Hill Ryerson Press, 2015.

SE-*** Mobile Applications Development

Contact Hours:
Theory =48

Credit Hours:
Theory = 3.0

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO	Domain & Taxonomy level	PLO
1.	***Explain*** different architectures & framework for Mobile Application development.	C-2	1
2.	***Develop*** mobile applications using market oriented software development environments.	C-6	3
3.	***Compare*** the different performance tradeoffs in mobile application development.	C-5	4
	Explain the impact of a sustainable engineering solution in societal and environmental context	C-2	7

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☑
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☑	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:
Mobiles Application Development Platform; introduction to HTML5 frameworks(ionic, Cordova) for Mobiles; Android OS: Architecture, Framework and Application Development; iOS: Architecture, Framework; Application Development with Windows Mobile; Android Studio; Fragments; Explicit and Implicit Intents; Displaying Notifications; Components of a Screen; Adapting to Display Orientation; Utilizing the Action Bar; Creating the User Interface; Listening for UI Notifications; Views; Persisting Data (SQLite, Shared Preferences); Sharing Data; Displaying Maps; Consuming Web Services Using HTTP; Web Services(Google Firebase): Accessing and Creating; Synchronous and Asynchronous Tasks; Foreground and Background Services; Publishing Android Applications; Deployment on PlayStore ; Challenges with Mobility and Wireless Communication; Location-aware Applications; Performance/Power Tradeoffs and its impact on Environment; Mobile Payment (Environment Friendly solution); Emerging Technologies (Kotlin, React Native, Flutter).

Teaching Methodology
- Lecturing

Assessment
Sessional (25%)
- Assignments
- Quizzes

Mid Term (25%)
Final Term (50%)

Text & Reference books:
1. Professional Android application development, Reto Meier, Wrox Programmer to Programmer, 2015.
2. iOS Programming: The Big Nerd Ranch Guide, Conway, J., Hillegass, A., & Keur, C., 5th Edition, 2014.
3. Android Programming: The Big Nerd Ranch Guides, Phillips, B. & Hardy, B., 2nd Edition, 2014.

SE-*** Multimedia Communication

Contact Hours:
Theory =48

Credit Hours:
Theory = 3.0

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** the audio/video representation, perception, equipment, A/V Compression Techniques, and applications.	Cognitive	2	1
2.	***Analyze*** performance of various coding algorithms for image and video processing.	Cognitive	4	4
3.	***Implement*** the optimized algorithm in a multimedia application.	Cognitive	4	3

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☑	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:
Overview of multimedia systems, Audio/Video fundamentals (representation, human perception, equipment and applications). Audio and video compression (e.g., JPEG, MPEG, H.26X, etc.), scalable coding, perceptual audio encoders. Performance comparison of coding algorithms, Algorithms for image and video processing, multimedia programming.

Teaching Methodology
- Lecturing

Assessment
Sessional (25%)
Mid Term (25%)
Final Term (50%)

Text & Reference books:

1. Fred Halsall, "Multimedia Communications: Applications, Networks, Protocols, and Standards", Latest Ed.
2. Puri, "Multimedia Systems, Standards and Networks", Marcel Dekker, Latest Ed.
3. Steve Heath, "Multimedia and Communication Technology", Focal Press, Latest Ed.
4. Bill Whyte, "Multimedia Telecommunication", Chapman and Hall, Latest Ed.

SE-*** Natural Language Processing

Contact Hours:
Theory =48

Credit Hours:
Theory = 3.0

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** techniques for information retrieval, language translation and text classification	Cognitive	2	1
2.	***Select*** standard corpora for NLP tasks	Cognitive	3	2
3.	***Analyze*** classic and stochastics algorithms for parsing natural language.	Cognitive	4	4

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☑	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course Contents:
Deterministic and stochastic grammars, Parsing algorithms, CFGs, Representing meaning / Semantics, Semantic roles, Temporal representations, Corpus-based methods, N-grams and HMMs, Smoothing and backoff, POS tagging and morphology, Information retrieval, Vector space model, Precision and recall, Information extraction, Language translation, Text classification, categorization, Bag of words model.

Teaching Methodology: Lecturing

Assessment
Sessional (25%): Assignments**,** Quizzes
Mid Term (25%)
Final Term (50%)

Text & Reference books:
1. Python Machine Learning, Sebastian Raschka. Publisher: Packt Publishing, 2015.
2.Natural Language Processing with Python: Analyzing Text with the Natural Language Toolkit Latest Edition, Steven Bird, Ewan Klein and Edward Loper Publisher: O'Reilly Media, 2009.
3.Speech and Language Processing, Latest Edition, Daniel Jurafsky and James H. Martin Publisher: Prentice Hall, 2000.

SE-*** Real Time Systems

Contact Hours:
Theory =**48**

Credit Hours:
Theory = **3.0**

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** the issues and basic concepts of real-time software development.	Cognitive	2	1
2.	**Analyze** embedded real-time systems using appropriate parameters.	Cognitive	4	2
3.	***Develop*** embedded-real-time systems to solve real world problems.	Cognitive	3	3

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:
Introduction to Real-Time Systems & Microcontrollers, Categories, Characteristics and challenges, Requirement Specification and Design, Elements of modular design, Concurrency, Real-time & other application areas, Real-Time operating Systems, Input/output Port Programming, Fundamentals of microprocessor based systems, Detail study of a Microcontroller Architecture, Real world interfacing technique, Real-time programming, Real-Time Analysis using Timers, Serial Port Programming, Addressing Modes, Interrupt Programming in Real Time Systems.

Teaching Methodology
- Lecturing

Assessment
Sessional (25%)
- Assignments
- Quizzes

Mid Term (25%)
Final Term (50%)

Text & Reference books:

1. Software Engineering for Real-Time Systems, Cooling J., Addison-Wesley.
2. Real-time Systems and Programming Languages, 2nd Edition, Burns A., Wellings A. J., Addison Wesley, UK.
3. Principles of Concurrent and Distributed Programming. Ben-Ari M., Addison-Wesley, 2006.
4. "The 8051 Microcontroller and Embedded Systems Using Assembly and C" 2nd Edition by Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinlay.

SE-*** Semantic Web

Contact Hours:
Theory =48

Credit Hours:
Theory = 3.0

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Understand*** the concept structure of the semantic web technology and how this technology revolutionizes the World Wide Web and its uses.	Cognitive	1	1
2.	***Understand*** the concepts of metadata, semantics of knowledge and resource, ontology, and their descriptions in XML-based syntax and web ontology language (OWL).	Cognitive	2	1
3.	***Examine*** logic semantics and inference with OWL.	Cognitive	4	3
4.	***Use*** ontology engineering approaches in semantic applications program semantic applications.	Cognitive	4	5

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☑	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:
Introduction to the semantic web, introduction to ontologies, ontology languages for the semantic web, Resource Description Framework (RDF), lightweight ontologies: RDF Schema, Web Ontology Language (OWL), query language for RDF: SPARQL, Ontology Engineering, Semantic web and Web 2.0 and applications of Semantic Web.

Teaching Methodology
- Lecturing

Assessment
Sessional (25%)
- Assignments/Projects
- Quizzes

Mid Term (25%)
Final Term (50%)

Text & Reference books:

1. Build Flexible Applications with Graph Data, Toby Segaran, Colin Evans, Jamie Taylor,302 pages O'Reilly Media, 2009.
2. Foundations of Semantic Web Technologies, Pascal Hitzler, Markus Krotzsch, Sebastian Rudolph,
3. Introduction to the Semantic Web and Semantic Web Services, Liyang Yu, Chapman and Hall/CRC, 2007

SE-*** Software Economics

Contact Hours:
Theory =48

Credit Hours:
Theory = 3

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Understand*** economic analysis techniques and their applicability to software engineering	Cognitive	2	1
2.	***Develop*** software cost estimation skills using industry standards.	Cognitive	3	2
3.	***Critically evaluate*** and discuss the issues in cost estimation of different applications in the real world with course participants and learners.	Cognitive	6	4

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☑	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:
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 Raylaigh 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.

Teaching Methodology
- Lectures

Assessment
Sessional (25%)
- Assignments + Quizzes + Project

Mid Term (25%)
Final Term (50%)

Text & Reference books:

1. Software Engineering Economics and Declining Budgets by Pamela T. Geriner, Thomas R. Gulledge, William P. Hutzler, Springer Verlag, 2012
2. Estimating Software Costs: Bringing Realism to Estimating, Capers Jones, McGraw-Hill Osborne Media; 2nd Edition, 2007.
3. Software Cost Estimation and Sizing Methods, Issues, and Guidelines, Shari Lawrence Pfleeger, Rand Publishing, 2005.

SE-*** Software Metrics

Contact Hours:
Theory =48

Credit Hours:
Theory = 3.0

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** the quantitative and empirical methods application to software engineering problems	Cognitive	2	1
2.	***Make use of*** the fundamentals of measurement, experimentation, data collection and analysis	Cognitive	3	3
3.	***Critically evaluate*** software matrices in the real world applications	Cognitive	5	2

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:
Overview of software metrics; Basics of measurements; Scope of software metrics, cost and effort estimation, data collection, quality models and measures, reliability models, security metrics, structural and complexity metrics, capability maturity assessment, management by metrics, evaluation of methods and tools, 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

Teaching Methodology
- Lecturing

Assessment
Sessional (25%)
Mid Term (25%)
Final Term (50%)

Text & Reference books:

1. Software Metrics: A Rigorous and Practical Approach, (3rd ed.), N.E. Fenton and J. Bieman, CRC Press, 2014,
2. Software Metrics: A Guide to Planning, Analysis, and Application, C. Ravindranath Pandian, Auerbach Publications, CRC Press Company, 2004.
3. Metrics and Models in Software Quality Engineering, Stephen H. Kan, 2nd ed., Addison-Wesley Professional, 2002.

SE-*** Systems Programming

Contact Hours:
Theory =48

Credit Hours:
Theory = 3.0

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** signals, systems calls, interrupts, file and I/O systems.	Cognitive	2	1
2.	***Asses*** computationally expensive algorithms on multi-core machines using multithreading and multiprocessing concepts.	Cognitive	5	2
3.	***Solve*** real world problems using the concepts of Inter Process Communication (IPC).	Cognitive	6	3

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:
Study of various utilities of operating systems in DOS, Windows and UNIX, System calls, interrupt handling, inter-process communication, and device handling through various ports, network handling, and device drivers and kernel concepts in operating systems. Processes, policies, process scheduling, types of file systems, interrupts, task scheduling and dispatching. Semaphores and their implementation. Concept of Writing and debugging programs on a microprocessor development system. Real time interfacing considerations with peripheral integrated circuits. Introduction to implementation of a real-time operating system, an on-line debugger, and real time interrupts for timing and I/O Unix Programming Environment, TCP Protocol Suite, Socket Programming, UDP and TCP Sockets, I/O Multiplexing including Non-blocking I/O, Advanced Socket Options, Name and Address Conversions, IPv4 and IPv6 Interoperability, Unix Domain Protocols, Broadcasting and Multicasting, Routing and Raw Sockets, Data Link Access, Daemon Processes, Posix Threads.

Teaching Methodology
- Lecturing

Assessment
Sessional (25%)
- Assignments
- Quizzes

Mid Term (25%)
Final Term (50%)

Text book:
1. UNIX Systems Programming: Communication, Concurrency, and Threads by K. A. Robbins and S. Robbins. Prentice Hall, 2003. ISBN: 0-13-042411-0.

SE-*** Visual Programming

Contact Hours:
Theory =48

Credit Hours:
Theory = 3.0

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** the fundamentals of visual programming		2	1
2.	***Make use of*** the different elements of a visual programming language as building blocks to develop correct, coherent programs.	Cognitive	3	3
4.	***Analyze*** various GUI's from accessibility perspective.	Cognitive	4	4

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☑	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:
Visual Programming Basics; Introduction to Events; Fundamentals of Event-driven Programming, message handling, user interfaces, graphics device interface, painting and drawing, windows management, input devices, resources, string and menu resource, dialogs and windows controls, common controls, dynamic link libraries, threads and synchronization, network programming, Building Class Libraries at the Command Line, Class Libraries, Using References, Assemblies, Private Assembly Deployment, Shared Assembly Deployment, Configuration Overview, Configuration Files, Programmatic Access to Configuration, Using SDK Tools for Signing and Deployment, Metadata, Reflection, Late Binding, Directories, Files, Serialization, Attributes, Memory Management and Garbage Collection, Threading and Synchronization, Asynchronous Delegates, Application Domains, Marshal by Value, Marshal by Reference, Authentication and Authorization, Configuring Security, Code Access Security, Code Groups, Evidence, Permissions, Role-Based Security, Principals and Identities, Using Data Readers, Using Data Sets, Interacting with XML Data, Tracing Event Logs, Using the Boolean Switch and Trace Switch Classes, Print Debugging Information with the Debug Class, Instrumenting Release Builds with the Trace Class, Using Listeners, and Implementing Custom Listeners.

Teaching Methodology
- Lecturing

Assessment
Sessional (25%)
- Assignments
- Quizzes

Mid Term (25%)
Final Term (50%)

Text & Reference books:

1. Visual C#: How to Program, Deitel and Deitel, 6/e Edition, Prentice Hall / Pearson Education, 2017.
2 . Programming in C# .NET, J.C. Bradley, A.C. Millspaugh, McGraw-Hill, 2014.
3 . Microsoft Visual C# 2013 Step by Step (Step by Step Developer), Sharp, J., 1st Edition (2013), Microsoft Press.

SE-308 Artificial Intelligence

Contact Hours:
Theory =48

Credit Hours:
Theory = **3.0**

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** the key concepts of artificial intelligence	Cognitive	2	1
2.	***Evaluate*** various AI search techniques to optimize problem formulation.	Cognitive	5	4
3.	**Develop** an AI system to solve real world problems.	Cognitive	6	3

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☑	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:
Introduction to Common Lisp. AI classical systems: General Problem Solver, rules, simple search, means-ends analysis. ELIZA, pattern matching, rule based translators, OPS-5. Knowledge Representation: Natural language, rules, productions, predicate logic, semantic networks, frames, objects, scripts. Search: Depth first search, breadth first search, best first search, hill climbing, min-max search, A* search. Symbolic Mathematics: student, solving algebra problems, translating English equations, solving algebraic equations, simplification rules, re-write rules, meta-rules, Macsyma, PRESS, ATLAS. Logic Programming: Resolution, unification, horn-clause logic, Prolog, Prolog programming. Sample case studies of shells and Knowledge Based Systems. A brief appreciation of state of the art computational techniques like neural networks, genetic algorithm, fuzzy sets.

Teaching Methodology

- Lecturing

Assessment:
- **Sessional (25%):** Assignments and Quizzes
- **Mid Term (25%)**
- **Final Term (50%)**

Text book:
1. Artificial Intelligence: Strategies for Complex Problem Solving, By: Goerge Luger, Edition: 6th, Publisher: Pearson Education, ISBN: 0321545893, Year of Publication: 2008.
2. Artificial Intelligence: A Modern Approach, By: Russell and Norvig, 3rd Edition, Publisher: Pearson Education, ISBN: 0136042597, Year of Publication: 2009

8. Contents of Software Engineering Supporting Electives

SE-*** Business Process Engineering

Contact Hours:
Theory =48

Credit Hours:
Theory = 3.0

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** salient issues in the changing business environment and critically reflect on how these modify the response of Business Process Engineering to achieve positive outcomes in such environments.	Cognitive	2	1
2.	***Investigate*** a business process through the framework of Event Controlled Process Chains and Business Process Modelling Notation.	Cognitive	4	2
3.	***Emulate*** authentic decision-making by designing an effective organizational plan for a workflow and exhibit contemporary professional practice by implementing a workflow using SAP WebFlow.	Cognitive	6	5

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☑	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:
Business process management, Manufacturing and services processes, Modelling and charting tools, Lean processes Improvement workshop techniques, Business process outsourcing, Re-engineering and improvement cases.

Teaching Methodology
- Lecturing

Assessment
Sessional (25%)
- Assignments
- Quizzes

Mid Term (25%)
Final Term (50%)

Text & Reference books:
1. Business Process Improvement; The Breakthrough Strategy for Total Quality, Productivity, and Competitiveness, H. J. Harrington
2. Business Intelligence: A Managerial Approach by Turban, Sharda, Delen, King, 2nd Edition, Prentice Hall (2011). ISBN: 13-978-0-136-10066-9.

SE-406 Formal Methods in Software Engineering

Contact Hours:
Theory =48

Credit Hours:
Theory = 3.0

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO	Domain & Taxonomy level	PLO
1.	***Describe*** the costs and benefits of formal methods.	C-1	1
2.	***Construct*** formal models of sequential software systems.	C-3	3
3.	***Implement*** sequential software systems based on formal models.	C-3	3
4.	***Demonstrate*** formal correctness of simple procedure.	C-3	3

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:
Introduction of Formal Methods, Limitations of testing and need for formal verification, Overview of logic and propositional calculus, Logical Connectives, Introduction to Hoare's Logic, Weakest pre-condition, The assignment axiom, Sequential composition, Conditional statements: Constructing & Reasoning about conditional statements, Inductive proofs and constructions, Patterns and invariant, From verification to construction, Design by Contract (DBC), The six principles of Design by contract, UML and Formal Methods, The Object Constraint Language (OCL), Algebraic Specifications, Modularity and re-usability, Model-based specifications, The Z (Zed) specification Language, Z Schemas and Schema Calculus, Promotions, Data and functional refinements, Limitations and Acceptance of Formal Methods, Seven Myths of Formal Methods.

Teaching Methodology
- Lecturing
- Written Assignments
- Quizzes

Assessment
Sessional (25%)
- Assignments
- Quizzes

Mid Term (25%)
Final Term (50%)

Text & Reference books:

1. Modern Formal Methods and Applications, Hossam A. Gabbar, Springer-Verlag 2006.
2. Formal Software Development: From VDM to Java, Charatan, Quentin, and Aaron Kans. Palgrave Macmillan, 2003.
3. Understanding Z: A Specification Language and its Formal Semantics. J. M. Spivey. 1988. Cambridge University Press, New York, NY, USA.

SE- *** Operation Research

Contact Hours:
Theory =48

Credit Hours:
Theory = 3.0

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** the characteristics of different types of decision-making environments, appropriate decision making approaches and tools to be used in each type.	Cognitive	2	1
2.	***Solve*** the Transportation and Assignment Models.	Cognitive	3	3
3.	***Understand*** the basic methodology for the solution of linear programs and integer programs.	Cognitive	2	1

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:
Introduction to operations research, History of operations research, Applications, Modeling the linear programming, Linear programming, Geometry, Solving the linear programming, the Simplex method, Shadow price, Theory of the simplex method, Duality, Dual theory, Sensitivity analysis, Other algorithms for linear programming, The dual simple method, Big – M method, The tow phase method, The transportation and assignment problems, The transportation problem, A streamlined simplex method for transportation problem, The assignment problem, A special algorithm for the assignment problem, Dynamic programming, Characteristic of dynamic programming, Deterministic dynamic programming, Integer programming, Prototype examples, BIP applications and formulation examples, Some perspectives on solving integer programming problems, The branch-and-cut approach to solve BIP problems, The incorporation of constraint programming.

Teaching Methodology
- Lecturing

Assessment
Sessional (25%)
- Assignments
- Quizzes

Mid Term (25%)
Final Term (50%)

Text & Reference books:

1. Frederick S. Hiller, Gerald J. Lieberman, Introduction to Operations Research, 9th Edition, English, McGraw-Hill, 2010.
2. W. Winston, Operations Research, Duxbury Press.
3. Operations Research: Applications and Algorithms, Wayne L Winston, Indian University, 4th edition, 2004

SE-*** Simulation and Modeling

Contact Hours:
Theory =48

Credit Hours:
Theory = 3.0

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** the model classification at different levels.	Cognitive	1	1
2.	***Analyze*** complex engineering systems and associated issues (using systems thinking and modelling techniques).	Cognitive	3	2
3.	***Apply*** advanced theory-based understanding of engineering fundamentals and specialist bodies of knowledge in the selected discipline area to predict the effect of engineering activities.	Cognitive	4	3
4.	***Analyze*** the simulation results of a medium sized engineering problem.	Cognitive	4	2

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:
Introduction to modelling and simulation, System analysis, Classification of systems, System theory basics, its relation to simulation, Model classification at conceptual, abstract, and simulation models levels, Methodology of model building, Simulation systems and languages, Means for model and experiment description, Principles of simulation system design, Parallel process modeling using Petri nets and finite automata in simulation, Models of queuing systems, Discrete simulation models, Model time, Simulation experiment control, Overview of numerical methods used for continuous simulation. System Dymola/ Modelica, Combined simulation, Special model classes, Models of heterogeneous systems, Cellular automata and simulation, Checking model validity, Verification of models, Analysis of simulation results, simulation results visualization, model optimization, generating, transformation, and testing of pseudorandom numbers with overview of commonly used simulation systems.

Teaching Methodology
- Lecturing

Assessment
Sessional (25%)
- Assignments
- Quizzes

Mid Term (25%)
Final Term (50%)

Text & Reference books:

1. Modeling and Simulation, Bungartz, H.-J., Zimmer, S., Buchholz, M., Pflüger, D., Springer-Verlag, 2014.
2. Simulation Modeling Handbook, A Practical Approach, Christopher A. Chung, CRC Press, 2004.
3. System design, modeling and simulation using Ptolemy II, Claudius Ptolemaeus, , Ver 2.0, Creative Commons Attribution-ShareAlike 3.0 Unported, 2014
4. Applied Simulation Modeling, Andrew F. Seila, Vlatko Ceric, Pandu Tadikamalla, Thomson Learning Inc., 2003.

SE-*** Stochastic Processes

Contact Hours:
Theory =48

Credit Hours:
Theory = 3.0

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Define*** basic concepts from the theory of Markov chains and present proofs for the most important theorems.	Cognitive	1	1
2.	***Compute*** probabilities of transition between states and return to the initial state after long time intervals in Markov chains.	Cognitive	3	3
3.	***Derive*** differential equations for time continuous Markov processes with a discrete state space.	Cognitive	3	3
4.	***Solve*** differential equations for distributions and expectations in time continuous processes and determine corresponding limit distributions.	Cognitive	3	3

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:
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

Teaching Methodology
- Lecturing

Assessment
Sessional (25%)
- Assignments
- Quizzes

Mid Term (25%)
Final Term (50%)

Text & Reference books:

1. Introduction to Probability Models, 11th Ed, Sheldon M. Ross, Academic Press 2014.
2. Essentials of stochastic processes, Durrett, Richard. Springer Science & Business Media, 2nd Ed, 2012.
3. Introduction to Stochastic Processes, 2nd Ed, G.F. Lawler, Chapman and Hall, Probability Series, 2006.

9. Contents of General Education/University Electives

BSH-120 Economics

Contact Hours:
Theory =48

Credit Hours:
Theory = 3.0

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** the fundamental concepts and dynamics of economics and economic decision making process in relevance with engineering environment scenario.	Affective	2	1
2.	***Analyze*** and ***Evaluate*** the concept of equivalence, value of money and its impact on different economic alternatives and Cost Benefit Analysis (CBA) in view of both quantitative and qualitative terms.	Affective	4	6
3.	***Evaluate*** the cost effectiveness of alternatives using the engineering economy methods and draw inferences for the investment decisions.	Affective	6	11

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☑
6	The Engineer and Society:	☑	12	Lifelong Learning:	☐

Course outline:

Introduction to engineering economics, Importance of Economic analysis in Decision making process, Decision Making Rationale, Types of Engineering Economic Decision an Engineer makes, Time Value of Money and its impact on economic analysis and decision making, Present Value, Future Value, Annual Payment Factor, economic equivalence, interest rate, types of interest factor, types of cash flows, Cost Benefit Analysis (CBA) and its types, Capital Resources and its Factors, Micro and macroeconomics, Break even analysis, Basis for comparison of alternatives, Evaluating replacement alternatives, Depreciation, Payback Period.

Teaching Methodology: Lecturing

Assessment: Mid Term (25%)**,** Final Term (50%)**,** Sessional Marks (25%)

Text & Reference books:

1. Software Engineering Economics and Declining Budgets by Pamela T. Geriner, Thomas R. Gulledge, William P. Hutzler, Springer Verlag, 2012
2. Estimating Software Costs: Bringing Realism to Estimating, Capers Jones, McGraw-Hill Osborne Media; 2nd Edition, 2007.
3. Software Cost Estimation and Sizing Methods, Issues, and Guidelines, Shari Lawrence Pfleeger, Rand Publishing, 2005.

BSH-220 Principles of Management

Contact Hours:
Theory =48

Credit Hours:
Theory = **3.0**

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** the concepts of project definition, life cycle, systems approach, and professional ethos.	Cognitive	2	1
2.	***Explain*** competency in project scooping, work definition, and work breakdown structure (WBS).	Cognitive	4	1
3.	***Solve*** the complex tasks of time estimation and project scheduling, including Program Evaluation and Review Technique (PERT) and Critical Path Method (CPM).	Cognitive	3	11
4.	***Apply*** project scheduling and MS Project with use of computers	Cognitive	3	5

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☑	11	Project Management:	☑
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

This course will cover three modules; basic management principles; Organizational behavior and Human Resource development. This course focuses on the basic managerial functions like planning, organizing, staffing, leading and controlling. It is specially oriented to modern management practices and decision making techniques essential for successful management of large organizations. The organizational behavior module covers how to analyze the behavior of humans in large groups, especially work settings. The course tries to inculcate a positive attitude in the students? relationships with equals, superiors and subordinates and prepares them to deal with different types of people in organizations in a professional and mutually beneficial way. The Human Resource Development module emphasizes the need of training and development for all levels of employees? ranging from frontline workers to senior managers? in order to bring about the development of the entire organization. Training activities are discussed, along with their costs and benefits, evaluative criteria, and impact on individual and organizational growth. Conflict management, motivation and team management is also covered in this course

Teaching Methodology: Lecturing
Assessment: Mid Term (25%)**,** Final Term (50%)**,** Sessional Marks (25%)

Text Book: Engineering Management by Dr. A.K. Gupta Published by S Chand
Reference Book: Engineering Management Meeting The Global Challenges by C.M.Chang

BSH-221 Human Resource Management

Contact Hours:
Theory =48

Credit Hours:
Theory = **3.0**

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1	***Understand*** management, organization structure, human behavior and effective utilization of human resource.	Cognitive	1	6
2	***Plan*** effectively for recruitment, selection and placing of workforce.	Cognitive	1	9
3	***Maximize*** the career **learning** and provide leadership qualities	Cognitive	1	9

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☐	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☑
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☑	12	Lifelong Learning:	☐

Course Outline: Introduction to HRM Essentials of Management, Organization and Components of Organization, People and Their Behavior Individual VS. Group Behavior, Personnel Management to Human Resource Management, HRM in a Changing Environment , Work Place Diversity ,Functions and Environment of HRM , Line and Staff Aspects of HRM, Legal Context of HR Decisions, Human Resource Planning (HRP) ,Strategic Planning and HRIS, Job Analysis, Sources of Recruitment , Selection, Selection Tests , Socialization, Training and Development, Maximizing Learning, Career Management , Performance Appraisal , Job Evaluation and Pricing, Compensation System Benefits ,Role of Money in Performance of Employees ,Motivation, Occupation, Health & Safety, Stress Management, Communication in Organization, Trade Unions, Conflict and Negotiation, Power and Politics, Employee Rights and Discipline , Leadership.

Teaching Methodology:
- Lecturing

Assessment: Sessional (25%) Mid Term (25%) Final Term (50%)

Text book:
- Essentials of Human Resource Management by Gary Dessler

BSH-310 Psychology

Contact Hours:
Theory =48

Credit Hours:
Theory = **3.0**

COURSE LEARNING OUTCOMES:
Upon successful completion of the course, the student will be able to:

S#	CLO Statement	Domain	Taxonomy Level	PLO
1	***Demonstrate*** familiarity with major concepts, theoretical perspectives, empirical findings Understand and apply psychological principles to personal, social, and organizational issues.	Cognitive	1	8
2	***Show*** insight into one's own and others' behavior and mental processes and apply effective strategies for self-management and self-improvement.	Affective	1	12
3	***Demonstrate*** information competence and the ability to use computers and other technology for many purposes.	Cognitive	1	6

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☐	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☑
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☑	12	Lifelong Learning:	☑

Course outline:
Psychology introduction, principals of scientific endeavor, objectivity, accuracy, healthy skepticism, the scientific method in Psychology, stating the problem forming a theory developing hypothesis, observation replicating results. Alternative methods of psychological enquiry, questionnaire, interview, naturalistic observations, case studies, combine technique. Schools of psychological thoughts, early traditions, structurism, functionalism, behaviorism, gestalt psychology, psycho analysis, psychological schools grow broader, humanistic psychology, cognitive psychology, biological perspective Social Psychology, group, social group, essential of a group, why we join a group, types of groups Leadership. Attitude, Socialization Mass media and communication, types of communication and mass media, functions of mass media, educational psychology, learner characteristics teacher characteristics, teacher expectation Special education, disabled mentally retarded and gifted students, Engineering Psychology, ergonomic and human factors History and scope of Engineering Psychology, Time and Motion of study, Person-Machine System, Work Space Design Types of learning, Cognitive learning, Insight, Latent learning, Generative learning, Learning to learn Personality and its assessments, Personality definition and nature, Theories of personality, Measurement of personality Tests of personality Stress Management and Anger Management, Source of stress, Response to stress, Coping, Health Psychology, Psychological Testing Intelligence, Theories of intelligence, Intelligence test Industrial/Organizational Psychology, Human Resource Psychology, Motivation of Job Performance, and Job Satisfaction Legal, Ethical, and Professional Issues

Teaching Methodology: Lecturing
Assessment: Sessional (25%) Mid Term (25%) Final Term (50%)

Text book:
1. A Collection of Psychological thoughts by Mrs Shahida Hussain Malik
2. Some Major Fields of Psychology by Prof. Faqih-ud-Din Hiader
3. Psychology (Sixth Edition) by Lester A. Lefton

10. CLOs Statements, Domain, Taxonomy Levels and Mapping with PLOs

SE-101 Introduction to Computing

S#	CLO Statement	Domain	Taxonomy Level	PLO
1	***Explain*** the history, types and building blocks(hardware components) of computer system.	Cognitive	2	1
2	***Illustrate*** the importance and use of system and application software and ***Outline*** the basic concepts of Computer Networks , Internet and world wide web.	Cognitive	2	1
3	***Understand*** the impact of Green Computing as sustainable engineering solution in societal and environmental context	Cognitive	2	7

SE-101L Introduction to Computing Lab

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Demonstrate*** knowledge about the practical aspects of computer system.	Cognitive	2	1
2.	***Acquire*** knowledge of different features of Operating Systems and typing tools to achieve the ability for developing solutions of Engineering problems.	Psychomotor	2	3
3.	***Justify*** time and resource allocation to complete the assigned task	Affective	3	11
4.	***Report*** the outcome of an experiment/task in standard format.	Affective	2	10

SE-102 Introduction to Programming

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Understand*** basic problem solving steps and logic constructs	Cognitive	2	1
2.	***Apply*** basic programing concepts	Cognitive	3	3
3.	***Analyze*** and implement algorithms to solve real world problems.	Cognitive	4	2

SE-102L Introduction to Programming Lab

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Implement*** various programming concepts to perform logical and computational tasks.	Psychomotor	3	3
2.	***Justify*** time and resource allocation to complete the assigned task	Affective	3	11
3.	***Report*** the outcome of an experiment/task in standard format.	Affective	2	10
4.	***Demonstrate*** knowledge about the practical aspects of Introduction of Programming Lab Course	Cognitive	2	1
5.	***Work*** effectively as an individual or in team to solve real world problems.	Affective	3	9

BSH-101 Islamic Studies

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Discuss*** basic concepts of Islam (faith, pillars, dawat, preaching and seerat).	Cognitive	2	12
2.	***Explain*** Basic Concepts of Hadith and Compilation of the Holy Quran	Cognitive	2	12
3.	***Discuss*** Islam as a complete code of life.	Cognitive	2	8

BSH-140 Calculus & Analytical Geometry

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Understand*** the ideas of rate of change and derivatives using the concept of limits and continuity.	Cognitive	1	1
2.	***Use*** the techniques of integration for solving and analyzing problems in integral calculus.	Cognitive	3	1
3.	***Apply*** the derivatives for solving different problems arising in engineering sciences.	Cognitive	3	1
4.	***Use*** the vector calculus and analytical geometry in multiple dimensions to solve different problems.	Cognitive	3	1

BSH-103 English Composition & Comprehension

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	Apply the acquire knowledge and skill of communication in their respective fields of engineering.	Cognitive	3	9
2.	Consolidate and extend students' vocabulary and grammar, that will enable them to present and contribute towards drafting of text effectively.	Affective	3	10
3.	Exhibit sound vocabulary and skills to use English in professional life.	Affective	2	12

SE-103 Discrete Structures

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** the basic concepts related to Discrete Structures	Cognitive	2	1
2.	***Solve*** problems using elementary set theory, logic, Venn diagrams, tree and graph theory.	Cognitive	3	3
3.	***Distinguish*** relations, functions and to solve counting problems.	Cognitive	4	2

SE-104 Object-Oriented Programming

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Understand*** principles of Object Oriented Programming paradigm.	Cognitive	2	1
2.	***Apply*** the object and their relationships to model & build object oriented solutions.	Cognitive	3	3
3.	***Examine*** an object oriented solution.	Cognitive	4	2

SE-104L Object Oriented Programming Lab

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Solve*** problems by applying the concepts of data encapsulation, inheritance and polymorphism.	Psychomotor	3	3
2.	***Justify*** time and resource allocation to complete the assigned task	Affective	3	11
3.	***Report*** the outcome of an experiment/task in standard format.	Affective	2	10
4.	***Demonstrate*** knowledge about the practical aspects of Introduction of Programming Lab Course	Cognitive	2	1
5.	***Work*** effectively as an individual or in team to solve real world problems.	Affective	3	9

BSH-130 Applied Physics

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Refresh*** students' previous knowledge of the basic physical laws and introduce them with the techniques of calculations at the higher levels.	Cognitive	1	1

2.	***Train/guide*** students in the analytical studies of different physical phenomenon pertaining to wave creation/propagation and characteristics.	Cognitive	3	2

BSH-201 Communication & Presentation Skills

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Understand*** and recognize their communication problems and respond accordingly.	Affective	1	10
2.	***Accelerate*** in writing, listening, speaking and reading ,and work towards desired response..	Affective	3	10
3.	***Organize*** their thoughts, expressions and ideas in effective ethical communication and revise for perfection..	Affective	5	8
4.	***Recognize*** and comprehend organizational communication system for improved knowledge of technical writing skills needed professionally. Understanding of do's and don'ts of technical communication.	Cognitive	2	12

SE-202 Data Structures and Algorithms

S#	CLO Statement	Domain	Taxonomy Level	PLO
1	***Relate*** procedural and/or OO Programming concepts for learning various data structures and associated algorithms	Cognitive	3	1
2	***Utilize*** Data Structures and standard algorithms for data manipulation, searching and sorting.	Cognitive	3	5
2	***Analyze*** simple algorithms for complexity in terms of time and space parameters.	Cognitive	4	2

SE-202L Data Structures & Algorithms Lab

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Demonstrate*** knowledge about the practical aspects of data structures & algorithms Lab Course	Cognitive	3	1
2.	***Achieve*** the ability for developing Data structures & Algorithms based solutions that meet specified needs for an engineering problem at hand	Psychomotor	4	3
3.	***Report*** an engineering task in the required format	Affective	2	10
4.	***Justify*** time and resource allocation to complete the assigned task	Affective	2	11
5.	***Work*** effectively as an individual or in team to solve real world problems.	Affective	3	9

SE-204 Introduction to Software Engineering

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Describe*** and apply the basic concepts of software engineering and workflow of software development process.	Cognitive	1	1
2.	***Develop*** small software design models.	Cognitive	3	3
3.	***Identify*** key principles and common methods for software project management such as scheduling, size estimation, cost estimation and risk analysis	Cognitive	3	2

BSH-102 Pakistan Studies

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** difference between ideological and non-ideological state.	Cognitive	2	8
2.	***Discuss*** Pakistan Movement, political and constitutional history of Pakistan.	Cognitive	2	8

3.	***Discuss*** current issues of Pakistan, their causes and solution, Population Dynamics in Pakistan.	Cognitive	2	7
4.	***Describe*** important historical event, geographical demarcation and to state deep understanding about past events and future learning.	Cognitive	1	12

BSH-142 Linear Algebra

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Demonstrate*** their competence with the ideas in linear algebra to work with linear systems and vector spaces.	Cognitive	1	1
2.	***Apply*** the knowledge of linear algebra to model and solve linear systems that appear in engineering sciences.	Cognitive	3	1
3.	***Apply*** the techniques of Gauss Elimination and Gauss Jordon for solving Homogeneous and Non-Homogeneous equations.	Cognitive	3	2
4.	***Use*** the vector space to describe the bases and dimension of different type problems and to solve different problems.	Cognitive	3	2

BSH-110 Professional Practices

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Defines*** the Engineering dimensions and problem solving approach ***and Produce*** a frame work for making reasonable moral choices and resolving moral dilemmas.	Cognitive	1	6
2.	***Develop*** the ability to manage confidentiality and fulfil the required responsibilities at a workplace.	Cognitive	3	8
3.	***Explain*** the impact of a sustainable engineering solution in societal and environmental context	Cognitive	2	7
4	***Judgmental and critic*** towards technological products.	Cognitive	5	8
5.	***Evaluate*** and deal with issues related to computers and to counter moral threats to the right of privacy.	Cognitive	5	8

SE-207 Software Requirements Engineering

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Understand*** fundamental concepts and activities of Requirements Engineering, Information elicitation techniques, Modeling scenarios.	Cognitive	1	1
3.	***Apply*** the techniques and tools required for requirements evaluation, selection, prioritization, management, traceability.	Cognitive	3	3
4	***Evaluate*** effective requirements in Software Requirements Specification (SRS) using clear, unambiguous requirements.	Cognitive	5	4

SE-209 Introduction to Database Systems

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** fundamental database concepts.	Cognitive	2	1
2.	***Design*** conceptual, logical and physical database schemas using relational data model.	Cognitive	3	3
3.	***Identify*** functional dependencies and resolve database anomalies by normalizing database tables.	Cognitive	3	3
4.	***Design & Experiment with*** databases using Structured Query Language (SQL) for database definition and manipulation.	Cognitive	3	3
5.	***Work*** effectively as an individual or in team to ***solve*** real world problems	Cognitive	3	9

SE-209L Introduction to Database System Lab

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Justify*** time and resource allocation to complete the assigned task	Affective	2	11
2.	***Achieve*** the ability for developing solutions that meet specified needs for an engineering problem at hand	Psychomotor	3	3
3.	***Report*** an engineering task in the required format	Affective	2	10
4.	***Demonstrate*** the learning of the concepts Database system	Cognitive	3	3
5.	***Work*** effectively as an individual or in team to ***solve*** real world problems	Cognitive	3	9

SE-304 Operating Systems

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** the core functions (*i.e.* process management, scheduling, memory management, file management, disk management) and structure of operating system.	Cognitive	2	1
2.	***Analyze*** algorithms of the core functions of operating systems with respect to the performance issues.	Cognitive	4	2
3.	***Analyze*** concurrency problems in multi-processing/multi-thread operating systems ***and Evaluate*** different process co-coordinating solutions.	Cognitive	5	2

SE-304L Operating Systems Lab

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Implement*** the core functions of the operating systems.	Psychomotor	3	3
2.	***Justify*** time and resource allocation to complete the assigned task	Affective	3	11
3.	***Report*** the outcome of an experiment/task in standard format.	Affective	2	10
4.	***Demonstrate*** knowledge about the practical aspects of Operating System.	Cognitive	2	1
5.	***Work*** effectively as an individual or in team to ***solve*** real world problems	Affective	3	9

BSH-341 Probability and Statistics

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Understand*** the basic concepts of probability, random variables, probability distribution, and joint probability distribution.	Cognitive	1	1
2.	***Use*** statistical methodology and tools in the engineering problem-solving process. Compute and interpret descriptive statistics using numerical and graphical techniques.	Cognitive	3	1
3.	***Compute*** point estimation of parameters, explain sampling distributions, and understand the central limit theorem.	Cognitive	3	2
4.	***Be able*** to visually presents the mathematical function.	Cognitive	2	2

SE-302 Software Design and Architecture

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Understand*** the importance and roles of design and its major activities in software systems.	Cognitive	1	1
2.	***Comprehend*** the design challenges and solutions with associated trade-offs	Cognitive	2	2
3.	***Design*** models and refine them to reflect implementation details	Cognitive	6	3
4.	***Use*** modern tools to implement and ***evaluate*** a system's architecture using different techniques.	Cognitive	5	5

SE-302L Software Design and Architecture Lab

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Justify*** time and resource allocation to complete the assigned task**.**	Affective	3	11
2.	***Manipulates*** tools and techniques for software designing and documentation of software systems.	Psychomotor	4	3
3	***Report*** the outcome of an experiment/task in standard format.	Affective	3	10
4	***Demonstrate*** knowledge about the practical aspects of Software design and architecture lab course.	Cognitive	2	1

SE-305 Computer Communication & Networks

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** the key terminologies, technologies and responsibilities of each layer in computer networks.	Cognitive	2	1
2.	***Analyze*** the service model of each layer in the TCP/IP protocol stack with respect to the protocols/algorithms.	Cognitive	4	2
3.	***Evaluate*** the working and performance of key technologies, algorithms and protocols.	Cognitive	5	2

SE-305L Computer Communication & Networks Lab

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Demonstrate*** the skills to configure network systems and troubleshoot common networking issues using appropriate tools.	Psychomotor	3	5
2.	***Construct*** different networking scenarios for the ***analysis*** of protocols.	Psychomotor	3	3
3.	***Justify*** time and resource allocation to complete the assigned task	Affective	3	11
4.	***Report*** the outcome of an experiment/task in standard format.	Affective	2	10
5.	***Work*** effectively as an individual or in team to solve real world problems	Affective	3	9
6.	***Demonstrate*** knowledge about the practical aspects of Computer Networks and Internet	Cognitive	2	1

BSH-301 Technical Writing

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Analyze*** their audience and adapt for them accordingly.	Affective	3	10
2.	***Employ*** the apt writing techniques for effectiveness.	Affective	4	10
3.	***Produce and present*** effective documents by incorporating the strategies for effective communication.	Affective	5	12

BSH-*** Environment & Sustainability

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** the importance of Environmental Science and its relationship with various segments of society and sectors of development.	Cognitive	2	7
2.	***Be familiar*** with current national, regional and global challenges for sustainable development.	Cognitive	2	7
3.	***Evaluate*** international environmental laws against domestic laws.	Cognitive	5	7

SE-206 Software Construction & Development

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** the principles of Software construction.	Cognitive	1	1
2.	***Apply*** patterns, frameworks and techniques for software Construction	Cognitive	3	3

3.	***Evaluate*** modern tools and techniques for software construction.	Cognitive	5	5

SE-206L Software Construction & Development Lab

S#	CLO Statement	Domain	Taxonomy Level	PLO
1	***Demonstrate*** knowledge about the practical aspects of Introduction of Programming Lab Course	Cognitive	2	1
2	***Justify*** time and resource allocation to complete the assigned task**.**	Affective	3	11
3	***Report*** the outcome of an experiment/task in standard format.	Affective	3	10
4	***Manipulates*** code generation algorithms for the design of a software system using software engineering approach.	Psychomotor	4	3
5.	***Work*** effectively as an individual or in team to solve real world problems.	Affective	3	9

SE-307 Software Quality Engineering

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Illustrate*** software testing and software quality assurance principles, processes and frameworks	Cognitive	2	1
2.	***Construct*** test case and test suites for completely testing different aspects of a software system.	Cognitive	3	3
3.	***Evaluate*** software testing techniques which are relevant for a particular case and know software reliability analysis tools and techniques	Cognitive	5	5
4.	***Work*** effectively as an individual or in team to solve real world problems.	Affective	4	9

SE-327 Information Security

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	**Explain** key concepts of information security such as design principles, cryptography, risk management, and ethics	Cognitive	2	1
3.	**Apply** various security and risk management tools for achieving information security and privacy.	Cognitive	3	5
3.	**Identify & Evaluate** appropriate techniques to tackle and solve problems in the discipline of information security.	Cognitive	4	3
4.	***Work*** effectively as an individual or in team to solve real world problems	Cognitive	3	9

SE-301 Web Engineering

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Produce*** static and responsive designs for web application.	Cognitive	3	3
2.	***Develop*** dynamic web application.	Cognitive	6	3
3.	***Apply*** techniques to resolve security threats in web applications.	Cognitive	3	3
4.	***Apply*** web standards for web application development.	Cognitive	3	3

SE-301L Web Engineering Lab

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	Achieve the ability for ***design/develop*** solutions that meet specified needs for an engineering problem at hand.	Psychomotor	4	3
2.	***Justify*** time and resource allocation to complete the assigned task	Affective	3	11
3.	***Report*** an engineering task in the required format.	Affective	2	10
4.	***Demonstrate*** knowledge about the practical aspects of Web Engineering Lab Course	Cognitive	2	1

5.	***Work*** effectively as an individual or in team to solve real world problems.	Affective	3	9

SE-401 Human Computer Interaction

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Understand*** fundamental concepts of computer components function regarding interaction with human and vice versa.	Cognitive	2	1
2.	***Analyze*** interface problems to recognize what design approach and interaction styles is required in the light of usability standards and guidelines.	Cognitive	2	2

SE-402 Software Project Management

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** principles of the project lifecycle and how to identify opportunities to work with learners on relevant and appropriate project scenarios to share this understanding.	Cognitive	2	1
2.	***Critically*** evaluate and discuss the issues around project management and its application in the real world with course participants and learners.	Cognitive	5	11
3.	***Choose*** project management techniques for IT projects to initiate, plan, execute and evaluate a project and work in teams to create a project plan for a project scenario that includes key tasks, critical path, dependencies and a realistic timeline.	Cognitive	3	9
4.	***Present*** strategies for gaining confidence in managing projects through simple project planning examples.	Cognitive	5	11

SE-309 Entrepreneurship

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** the core concepts and basic theories of entrepreneurship.	Cognitive	2	1
2.	***Design*** an appropriate business plan and select suitable business model.	Cognitive	6	3
3.	**Explain** the impact of a sustainable engineering solution in societal and environmental context.	Cognitive	2	7

SE-405 Final year Project

S#	CLO Statement	Domain, TL	PLO
1.	***Demonstrate*** the ability to apply engineering knowledge to undertake complex engineering activity.	C2	1
2.	***Break down*** the development of an engineering product, system or concept.	P4	2
3.	***Apply*** relevant engineering principles and techniques to design, operate, and simulate the development of an engineering product, system or concept.	P6	3
4.	***Prioritize*** the collected data and analyze result in order to make relevant decision on the performance of an engineering product, system or concept.	P5	4
5.	***Use*** modern equipment and tools for investigating and presenting solutions to complex engineering problems/project.	P2	5
6.	***Explain*** the propose engineering solutions to the identified problem for the betterment of Society/humankinds.	A3	6
7.	***Reports*** the impact of engineering solutions in environmental context and present the need for sustainable development.	A2	7
8.	***Practice*** ethical and professional norms for the implementation of engineering projects.	A2	8

S#	CLO Statement	Domain, TL	PLO
9.	***Choose*** project management techniques for project to work in a team to create a project plan for a project scenario.	A3	9
10	***Relate and defend*** development of solutions effectively through written and oral mode with the aid of multimedia tools.	A4	10
11	***Choose*** project management techniques for project to initiate, plan, execute and evaluate a project.	A5	11
12	Show Motivation for **acquiring** extra technical knowledge in order to solve real life problems.	P2	12

SE-410 Software Re-Engineering

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** the concepts and technique of software re-engineering.	Cognitive	2	1
2.	***Analyze*** and understand maintenance related problems associated with object oriented software systems.	Cognitive	4	2
3.	Able to perform complex ***design*** reengineering and reverse engineering problems.	Cognitive	5	3

SE-*** Agent Based Software Engineering

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** the agent system terminology and development process of agent-based systems.	Cognitive	2	1
2.	***Illustrate*** the techniques to design agent-based system.	Cognitive	2	3
3.	**M*odify*** architecture of the current software systems and restructure them to be agent-based	Cognitive	6	3

SE-*** Big Data Analytics

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Provide*** fundamental information to get insight into the challenges with big data.	Cognitive	1	1
2.	***Understand*** techniques for storing and processing large amounts of structured and unstructured data	Cognitive	2	1
3.	***Application*** of big data concepts to get valuable information on market trends	Cognitive	3	3
4.	***Select*** a suitable technique and implement a sample project for extracting useful information from a mid sized dataset.	Cognitive	5	4

SE-*** Cloud Computing

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** the core issues of cloud computing such as security, privacy, consistency and interoperability.	Cognitive	2	1
2.	***Develop and deploy*** cloud application using popular cloud platforms	Cognitive	5	5
3.	***Compare*** the key trade-offs between multiple design approaches used for cloud systems.	Cognitive	5	3
4.	***Write*** a comprehensive case study analyzing different cloud computing solutions	Cognitive	4	10

SE-*** Computer Graphics

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** the structure and function of display devices and Computer Graphic Fundamentals.	Cognitive	2	1

2.	***Compare*** key algorithms for modelling and rendering graphical data	Cognitive	4	4
3.	***Develop*** applications of computer graphics	Cognitive	6	3

SE-*** E-Commerce

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** the concepts and standards related to the discipline of E-Commerce.	Cognitive	2	1
2.	***Analyze*** the existing payment procedures for given business scenarios	Cognitive	4	4
3.	***Develop*** solutions for complex real world problems found in Ecommerce.	Cognitive	6	3

SE-*** Global Software Development

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Understand*** the principles of the software engineering in context of global software development.	Cognitive	2	1
2.	***Evaluate*** and discuss the issues around global software development and techniques for managing distributed projects.	Cognitive	4	2
3.	***Understand*** Configuration management systems, release management and task assignments in context of distributed projects.	Cognitive	2	1
4.	***Acquire*** strategies for effectively dividing tasks among teams, controlling the communication among teams, planning tasks and collaborating on modular project with the help of realistic examples.	Cognitive	3	9

SE-*** Information System Audit

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Understand*** the concepts and standards related to the discipline of Information System Audit.	Cognitive	1	1
2.	***Analyze*** and Audit Information Systems.	Cognitive	4	4

SE-*** Management Information System

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Define*** concept of information technology management	Cognitive	1	1
2.	***Apply*** decision making approach to solve common business problem	Cognitive	3	3
3.	***Prepare*** effective solutions to business problems, and design a database application to solve a business problem.	Cognitive	3	3

SE-*** Mobile Applications Development

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** different architectures & framework for Mobile Application development.	Cognitive	2	1
2.	***Develop*** mobile applications using market oriented software development environments.	Cognitive	6	3
3.	***Compare*** the different performance tradeoffs in mobile application development.	Cognitive	5	4
	Explain the impact of a sustainable engineering solution in societal and environmental context	Cognitive	2	7

SE-*** Multimedia Communication

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** the audio/video representation, perception, equipment, A/V Compression Techniques, and applications.	Cognitive	2	1
2.	***Analyze*** performance of various coding algorithms for image and video processing.	Cognitive	4	4
3.	***Implement*** the optimized algorithm in a multimedia application.	Cognitive	4	3

SE-*** Natural Language Processing

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** techniques for information retrieval, language translation and text classification	Cognitive	2	1
2.	***Select*** standard corpora for NLP tasks	Cognitive	3	2
3.	***Analyze*** classic and stochastics algorithms for parsing natural language.	Cognitive	4	4

SE-*** Real Time Systems

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** the issues and basic concepts of real-time software development.	Cognitive	2	1
2.	**Analyze** embedded real-time systems using appropriate parameters.	Cognitive	4	2
3.	***Develop*** embedded-real-time systems to solve real world problems.	Cognitive	3	3

SE-*** Semantic Web

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Understand*** the concept structure of the semantic web technology and how this technology revolutionizes the World Wide Web and its uses.	Cognitive	1	1
2.	***Understand*** the concepts of metadata, semantics of knowledge and resource, ontology, and their descriptions in XML-based syntax and web ontology language (OWL).	Cognitive	2	1
3.	***Examine*** logic semantics and inference with OWL.	Cognitive	4	3
4.	***Use*** ontology engineering approaches in semantic applications program semantic applications.	Cognitive	4	5

SE-*** Software Economics

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Understand*** economic analysis techniques and their applicability to software engineering	Cognitive	2	1
2.	***Develop*** software cost estimation skills using industry standards.	Cognitive	3	2
3.	***Critically evaluate*** and discuss the issues in cost estimation of different applications in the real world with course participants and learners.	Cognitive	6	4

SE-*** Software Metrics

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** the quantitative and empirical methods application to software engineering problems	Cognitive	2	1
2.	***Make use of*** the fundamentals of measurement, experimentation, data collection and analysis	Cognitive	3	3
3.	***Critically evaluate*** software matrices in the real world applications	Cognitive	5	2

SE-*** Systems Programming

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** signals, systems calls, interrupts, file and I/O systems.	Cognitive	2	1
2.	***Asses*** computationally expensive algorithms on multi-core machines using multithreading and multiprocessing concepts.	Cognitive	5	2
3.	***Solve*** real world problems using the concepts of Inter Process Communication (IPC).	Cognitive	6	3

SE-*** Visual Programming

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	Explain the fundamentals of visual programming		2	1
2.	***Make use of*** the different elements of a visual programming language as building blocks to develop correct, coherent programs.	Cognitive	3	3
4.	***Analyze*** various GUI's from accessibility perspective.	Cognitive	4	4

SE-308 Artificial Intelligence

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** the key concepts of artificial intelligence	Cognitive	2	1
2.	***Evaluate*** various AI search techniques to optimize problem formulation.	Cognitive	5	4
3.	**Develop** an AI system to solve real world problems.	Cognitive	6	3

SE-*** Business Process Engineering

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** salient issues in the changing business environment and critically reflect on how these modify the response of Business Process Engineering to achieve positive outcomes in such environments.	Cognitive	2	1
2.	***Investigate*** a business process through the framework of Event Controlled Process Chains and Business Process Modelling Notation.	Cognitive	4	2
3.	***Emulate*** authentic decision-making by designing an effective organizational plan for a workflow and exhibit contemporary professional practice by implementing a workflow using SAP WebFlow.	Cognitive	6	5

SE-406 Formal Methods in Software Engineering

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Describe*** the costs and benefits of formal methods.	Cognitive	1	1
2.	***Construct*** formal models of sequential software systems.	Cognitive	3	3

3.	***Implement*** sequential software systems based on formal models.	Cognitive	3	3
4.	***Demonstrate*** formal correctness of simple procedure.	Cognitive	3	3

SE- *** Operation Research

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** the characteristics of different types of decision-making environments, appropriate decision making approaches and tools to be used in each type.	Cognitive	2	1
2.	***Solve*** the Transportation and Assignment Models.	Cognitive	3	3
3.	***Understand*** the basic methodology for the solution of linear programs and integer programs.	Cognitive	2	1

SE-*** Simulation and Modeling

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** the model classification at different levels.	Cognitive	1	1
2.	***Analyze*** complex engineering systems and associated issues (using systems thinking and modelling techniques).	Cognitive	3	2
3.	***Apply*** advanced theory-based understanding of engineering fundamentals and specialist bodies of knowledge in the selected discipline area to predict the effect of engineering activities.	Cognitive	4	3
4.	***Analyze*** the simulation results of a medium sized engineering problem.	Cognitive	4	2

SE-*** Stochastic Processes

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Define*** basic concepts from the theory of Markov chains and present proofs for the most important theorems.	Cognitive	1	1
2.	***Compute*** probabilities of transition between states and return to the initial state after long time intervals in Markov chains.	Cognitive	3	3
3.	***Derive*** differential equations for time continuous Markov processes with a discrete state space.	Cognitive	3	3
4.	***Solve*** differential equations for distributions and expectations in time continuous processes and determine corresponding limit distributions.	Cognitive	3	3

BSH-120 Economics

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** the fundamental concepts and dynamics of economics and economic decision making process in relevance with engineering environment scenario.	Affective	2	1
2.	***Analyze*** and ***Evaluate*** the concept of equivalence, value of money and its impact on different economic alternatives and Cost Benefit Analysis (CBA) in view of both quantitative and qualitative terms.	Affective	4	6
3.	***Evaluate*** the cost effectiveness of alternatives using the engineering economy methods and draw inferences for the investment decisions.	Affective	6	11

BSH-220 Principles of Management

S#	CLO Statement	Domain	Taxonomy Level	PLO
1.	***Explain*** the concepts of project definition, life cycle, systems approach, and professional ethos.	Cognitive	2	1
2.	***Explain*** competency in project scooping, work definition, and work breakdown structure (WBS).	Cognitive	4	1
3.	***Solve*** the complex tasks of time estimation and project scheduling, including Program Evaluation and Review Technique (PERT) and Critical Path Method (CPM).	Cognitive	3	11
4.	***Apply*** project scheduling and MS Project with use of computers	Cognitive	3	5

BSH-221 Human Resource Management

S#	CLO Statement	Domain	Taxonomy Level	PLO
1	***Understand*** management, organization structure, human behavior and effective utilization of human resource.	Cognitive	1	6
2	***Plan*** for recruitment, selection and placing of workforce and further to **understand** the importance of training and development of employee's skills	Cognitive	1	9
3	***Maximize*** the career **learning** and provide leadership qualities	Cognitive	1	9

BSH-310 Psychology

S#	CLO Statement	Domain	Taxonomy Level	PLO
1	***Demonstrate*** familiarity with major concepts, theoretical perspectives, empirical findings Understand and apply psychological principles to personal, social, and organizational issues.	Cognitive	1	8
2	***Show*** insight into one's own and others' behavior and mental processes and apply effective strategies for self-management and self-improvement.	Affective	1	12
3	***Demonstrate*** information competence and the ability to use computers and other technology for many purposes.	Cognitive	1	6

11. Courses Mapping to PLOs-Annexure-D of PEC's SAR

The table below shows a summary of CLOs mapping to different PLOs. The numbers 1, 2, 3 show the intensity a specific CLO targeting the PLO. More than one entry in a cell means that more than one CLOs have been mapped to a certain PLO. Bloom's Taxonomy levels 1 is **Low** (entry 3 in the cell), 2-3 is **medium** (entry 2 in the cell) and above 3 is **high** (entry 1 in the cell).

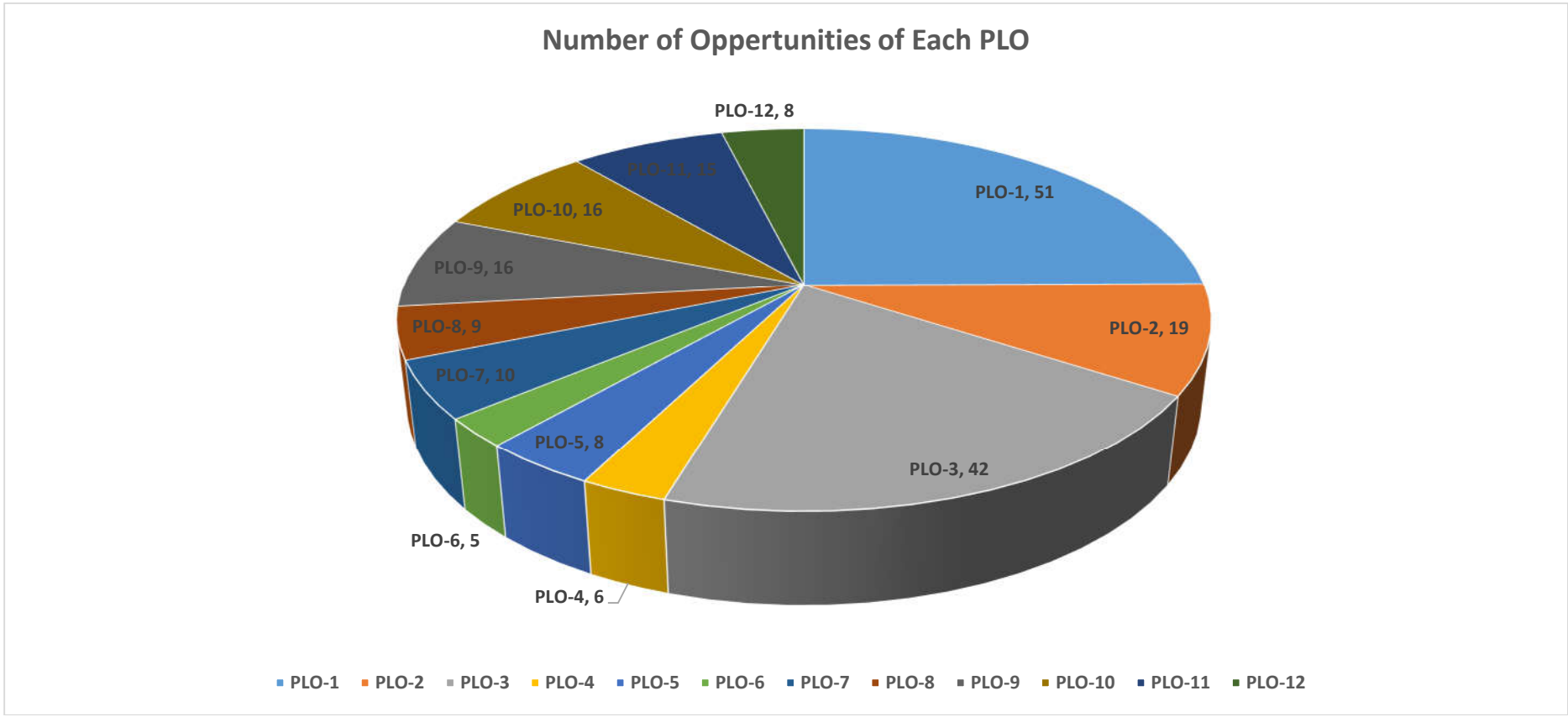
Semester#	Course Code	Course Title	PLO No. (Level of Emphasis of PLO (1: High; 2= Medium; 3=Low))											
			1	2	3	4	5	6	7	8	9	10	11	12
1	SE-101	Introduction to Computing	2,2						2					
	SE-101L	Introduction to Computing Lab	2		2							2	2	
	SE-102	Introduction to Programming	2	1	2									
	SE-102L	Introduction to Programming Lab	2		2						2	2	2	
	BSH-103	English Composition & Comprehension									2	2		2
	BSH-140	Calculus & Analytic Geometry	2,2,2,3											
	BSH-101	Islamic Studies								2				2,2
2	SE-103	Discrete Structures	2	1	2									
	SE-104	Object Oriented Programming	2	1	2									
	SE-104L	Object Oriented Programming Lab	2		2						2	2	2	
	BSH-201	Communication & Presentation Skills								1		2,3		2
	BSH-130	Applied Physics	3	2										
	BSH-***	General Education Elective-I (**Principles of Management)**	2,1				2						2	
3	SE-204	Introduction to Software Engineering	3	2	2									
	SE-202	Data Structures and Algorithms	2	1			2							
	SE-202L	Data Structures and Algorithms Lab	2		1						2	2	2	
	BSH-102	Pakistan Studies							2	2,2				3
	BSH-142	Linear Algebra	2,3	2,2										
	BSH-110	Professional Practices						3	2	2,1,1				
	BSH-***	General Education Elective-II (**Economics**)	2					1					1	
	SE-207	Software Requirement Engineering	3		2	1								
	SE-209	Introduction to Database Systems	2		2, 2, 2						2			
	SE-209L	Introduction to Database Systems Lab			2, 2						2	2	2	
	SE-304	Operating Systems	2	1, 1										
	SE-304L	Operating Systems Lab	2		2						2	2	2	
	BSH-341	Probability and Statistics	3,2	2,2										
	BSH-***	General Education Elective-III (**Psychology**)						3		3				3
	SE-302	Software Design & Architecture	3	2	1		1							

Semester#	Course Code	Course Title	PLO No. (Level of Emphasis of PLO (1: High; 2= Medium; 3=Low))											
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
5	SE-302L	Software Design & Architecture Lab	2		1							2	2	
	SE-305	Computer Communication & Networks	2	1, 1										
	SE-305L	Computer Communication & Networks Lab	2		2		2				2	2	2	
	BSH-301	Technical Writing										1,2		1
	BSH-***	Environment and Sustainability							2,2,1					
	SE-***	SE Supporting Elective-I (**Operation Research**)	2,2		2									
	SE-***	SE Supporting Elective-II (**Stochastic Processes**)	3		2,2,2									
6	SE-206	Software Construction & development	3		2		1							
	SE-206L	Software Construction Lab	2		1						2	2	2	
	SE-307	Software Quality Engineering	2		2		1				1			
	SE-327	Information Security	2		1		2				2			
	SE-301	Web Engineering			2, 2, 2, 1									
	SE-301L	Web Engineering Lab	2		1						2	2	2	
	SE-***	SE Elective-I (**Artificial Intelligence**)	2		1	1								
	SE-***	SE Supporting Elective-III (**Formal Methods for Software Engineering)**	3		2, 2, 2									
7	SE-401	Human Computer Interaction	2	2										
	SE-402	Software Project Management	2								2		1, 1	
	SE-309	Entrepreneurship	2		1				2					
	SE-***	SE Elective-II (**Mobile Application Development**)	2		1	1			2					
	SE-***	SE Elective-III (**Real Time Systems**)	2	1	2									
	SE-405	Final Year Project	2	1	1	1	2	2	2	2	2	1	1	2
8	SE-410	Software Re-Engineering	2	1	1									
	SE-***	SE Elective-IV(**Big Data Analytics**)	3, 2		2	1								
	SE-***	SE Elective-V (**Computer Graphics**)	2		1	1								
	BSH-***	General Education Elective-IV (**Human Resource Management**)						3			3,3			

12. Number of Opportunities for Each PLO

The following table shows the opportunities for attainment of each PLO. One mapping of CLO in a course is counted one opportunity for a certain PLO.

PLO No	PLO	Low Level Opportunities	Medium Level Opportunities	High Level Opportunities	Total Opportunities
PLO-1	Engineering Knowledge	11	39	1	51
PLO-2	Problem Analysis	0	8	11	19
PLO-3	Design/Development of Solutions	0	29	13	42
PLO-4	Investigation	0	0	6	06
PLO-5	Modern Tool Usage	0	5	3	08
PLO-6	The Engineer and Society	3	1	1	05
PLO-7	Environment and Sustainability	1	8	1	10
PLO-8	Ethics	1	5	3	09
PLO-9	Individual & Team Work	2	13	1	16
PLO-10	Communication	1	13	2	16
PLO-11	Project Management	0	11	4	15
PLO-12	Life Long Learning	2	5	1	08


Number of Oppertunities of Each PLO
PLO-12, 8
PLO-11, 15
PLO-10, 16
PLO-9, 16
PLO-8, 9
PLO-7, 10
PLO-5, 8
PLO-6, 5
PLO-4, 6
PLO-1, 51
PLO-2, 19
PLO-3, 42
PLO-1
PLO-2
PLO-3
PLO-4
PLO-5
PLO-6
PLO-7
PLO-8
PLO-9
PLO-10
PLO-11
PLO-12

13. Knowledge, Skills and Aptitude Distribution of the Curriculum

The following graph shows the percent distribution of the Curriculum over Knowledge, Skills and Aptitude.