Curriculum

of

Bachelor of Science in Software Engineering

BS (SE)

Revised: Summer 2016

Department of Computer Science,

School of Systems and Technology,

University of Management and Technology,

Lahore, Pakistan

Table of Contents

Contents

Table of Contents 2

1. Curriculum Review Committee 3
2. Preface 4
3. Acknowledgment 5
4. Program Objective 6
5. Program Structure 7
6. Semester-wise road map 9
7. Course outlines of all courses (Category-wise) 11

7.1 Computing Core 11

7.2 Program Core 22

7.3 Supporting Core 28

7.4 University Core 32

7.5 Program Elective 38

7.6 Supporting Electives 62

7.7 University Electives 63

1. Curriculum Review Committee

Following are the members of the curriculum review committee who were involved in the revision of the BS-SE program.

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   Professor and Dean, School of Systems and Technology

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   Associate Professor and Chairperson, Department of Computer Science

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   Associate Professor and Director, BS CS Program

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   Assistant Professor and Program Advisor, BS SE Program

5. Ms. Hafsa Zafar

   Assistant Professor and Program Advisor, BS IT Program

2. Preface

The curriculum of Software Engineering is very dynamic and requires continuous revision. We have been revising our elective courses and their contents to cope with these dynamic requirements of the program. However, a need for some serious overhauling of the curriculum was now recognized based on the feedback from academic and industry experts, our faculty members, and the students. The revised curriculum conforms to the guidelines by National Computing Education Accreditation Council (NCEAC) and Higher Education Commission (HEC) of Pakistan. We believe that the revised curriculum will prove to be more recent, relevant, applied and standardized. Major changes from the previous curriculum are summarized below:

1. One credit lab work in addition to the 3 theory credits has been added to courses including Introduction to Computing, Programming Fundamentals, Object Oriented Programming, Data Structures, Computer Networks, Operating Systems, and Databases.
2. Islamic Studies II has been dropped.
3. Structured Programming has been dropped.
4. Applied Mechanics and Applied Physics have been dropped. Basic Electronics has been added.
5. Computer Organization and Assembly Language has been dropped.
6. Differential Equations and Calculus II are no more required courses. However, they can be registered as supporting electives.
7. Professional Practices has been added as General Education Core.
8. The total number of courses drops from 47 to 42, as suggested by HEC.
9. The total number of credit hours drops from 139 to 135.

We hope that introducing more lab work and dropping some lesser relevant courses will help us provide our students a practical and more focused learning experience with solid foundations, state-of-the-art skills, and promising career prospects.

3. Acknowledgment

We are thankful to Allah Almighty for all his blessings, and enabling us complete this important task. We acknowledge and admire Dr. Hasan Suhaib Murad, the honorable rector of UMT, for his vision, motivation and support, moral as well as logistic, to make our academic programs up-to-date by including state-of-the-art courses, materials and practices. We also acknowledge the support of our faculty members for sharing their invaluable experiences and pieces of advice to improve the curriculum.

4. Program Objective

The BS-Software Engineering program at UMT has been designed to produce graduates who are accustomed to a range of software engineering topics essential for designing and maintaining reliable and effective software systems. The program is designed to give its students hands on experience to cover all aspects of software engineering including problem modeling and analysis, software design and development, software verification and validation, software quality and testing and software management.

After completing the program, a student will be able to:

- apply the basic principles of software engineering for providing reliable software.
- design, implement, deploy and maintain practical software systems.
- verify and validate software systems.
- understand and apply software project management skills: measurement, estimation, costing, planning, deployment and tracking of resources.
- communicate effectively in career and educational environments, and
- apply his/her knowledge and skills to develop a career in software business or industry, or for graduate study in software engineering or other scientific or technical fields, in general.

5. Program Structure

a) Category-wise course distribution

5.1 Computing Core (10 Courses + Final Year Project)

- Introduction to Computing
- Programming Fundamentals
- Object Oriented Programming
- Discrete Structures
- Digital Logic Design
- Data Structure and Algorithms
- Introduction to Database Systems
- Operating Systems
- Computer Communication Networks
- Human Computer Interaction

5.2 Program Core (6 courses)

- Software Engineering
- Object Oriented Software Engineering (Software Construction)
- Software Requirement and Specifications
- Software Verification and Validation
- Software Architecture Design
- Software Project Management

5.3 Supporting Core (4 courses)

- Calculus I
- Basic Electronics
- Linear Algebra
- Probability and Statistics

5.4 University Core (6 courses)

- Functional English (English I)
- Communication Skills (English II)
- Technical Report Writing (English III)
- Islamic Studies
- Pakistan Studies
- Professional Practices

5.5 Program Electives 7 Courses

5.6 Supporting Electives 3 Courses

5.7 University Electives 4 Courses

Note: Elective courses can be offered from the list as required and decided every semester. The list is available on SST Website and is not exhaustive. Sample elective courses are presented in the Course Outlines section.

b) Comparison of our structure with HEC

Credit Hours Distribution (Our)

Major Areas	Core/Required	Elective	Credit Hours
Computing Foundation	44	21	84
Software Engineering	19		
Supporting Studies	12	9	21
General Education	18	12	30
Total			**135**

Credit Hours Distribution (HEC)

Major Areas	Core/Required	Elective	Credit Hours
Computing Foundation	46	21	85
Software Engineering	18		
Supporting Studies	12	9	21
General Education	15	12	27
Total			**133**

6. Semester-wise road map

BS (SE): 4-year Program, 8 Semesters, 42 Courses, 135 Credit Hours

Semester 1 **Semester 2**

Course Code	Course Title	Pre-req	Credit Hours	Course Code	Course Title	Pre-req	Credit Hours
CC 1011w	Introduction to Computing		4 (3+1)		Programming Fundamentals		4 (3+1)
CC 1311w	Discrete Structures		3		Basic Electronics		3 (2+1)
	Calculus and Analytical Geometry (Calculus-I)		3		Communication Skills (English-II)	Eng I	3
	Functional English (English-I)		3		Supporting Elective-I (e.g., Calculus II)		3
	Islamic Studies		3		GE/University Elective-I		3
	Semester Credits		**16**		**Semester Credits**		**16**

Semester 3 **Semester 4**

Course Code	Course Title	Pre-req	Credit Hours	Course Code	Course Title	Pre-req	Credit Hours
CC 2211w	Digital Logic and Design		4 (3+1)	CC 2711	Software Engineering		3
CC 1111w	Object Oriented Programming	PF	4 (3+1)		Supporting Elective-II (e.g., Operations Research)		3
CC 2421w	Introduction to Database Systems		4 (3+1)	CC 2411w	Data Structures and Algorithms	OOP	4 (3+1)
	Probability and Statistics		3		Linear Algebra		3
	GE/University Elective II		3		Technical Report Writing (English-III)		3
	Semester Credits		**18**		**Semester Credits**		**16**

Semester 5 **Semester 6**

Course Code	Course Title	Pre-req	Credit Hours	Course Code	Course Title	Pre-req	Credit Hours
SE 3721w	Object Oriented Software Engineering (Software Construction)	OOP , SE	4 (3+1)	SE 3741w	Software Verification and Validation (SQT)	SE	3
SE 3731w	Software Requirement and Specifications	SE	3	SE 3751w	Software Architecture and Design	SE	3
CC 3021w	Operating Systems	DSA	4 (3+1)	CC 3611w	Computer Communication and Networks		4 (3+1)
	SE Elective I	SE	3		SE Elective II	SE	3
	Supporting Elective III (Analysis of Algorithms)		3		SE Elective-III	SE	3
					SE Elective IV	SE	3
	Semester Credits		**17**		**Semester Credits**		**19**

Semester 7 **Semester 8**

Course Code	Course Title	Pre-req	Credit Hours	Course Code	Course Title	Pre-req	Credit Hours
CC 4981w	Final Year Project-I		3	CC 4991w	Final Year Project-II	FYP-II	3
SE 3761w	Software Project Management	SE	3		GE/University Elective III		3
CC 3041w	Human Computer Interaction		3		GE/University Elective IV		3
	SE Elective-V	SE	3		Professional Practices		3
	SE Elective-VI	SE	3		SE Elective-VII	SE	3
	Pakistan Studies		3				
	Semester Credits		**18**		**Semester Credits**		**15**

7. Course outlines of all courses (Category-wise)

7.1 Computing Core

Course Name: Introduction to Computing
Course Code: CC1011w
Credit Hours: 4(3+1)
Prerequisites: NA
Objectives: Upon successful completion of this course students should be able to: ▪ Understand the basic components of the computer ▪ Understand the basic working of the computer ▪ Be able to use the computer for common applications like word processing and spreadsheets ▪ Be able to design the logic of a solution for a problem using pseudocode ▪ Be able to understand the concepts of computer networking and communications ▪ Be able to understand and apply the concepts of relational databases
Course Outline: This course introduces the fundamentals of computers and information technology to beginners. Initially, the students are familiarized with the computer, its components and working. They are trained to use the computer and different common application software's. They are then taught the techniques of logic development for solving problems using pseudocode. They are also introduced to the concepts of relational databases, computer networking and internetworking.
Reference Material: Computing Fundamentals, Peter Norton, McGrawHill, 5th Ed.

Course Name: Programming Fundamentals
Course Code:
Credit Hours: 4(3+1)
Prerequisites: -
Objectives: This course is designed as an entry level programming course for students who have no prior programming experience. In this course, the students will be introduced about the basic concepts of programming using C++ language. By the end of the course students should be able to use a computer to solve problems by developing simple algorithms and then implement them using C++. Students should be able to understand and determine the computational complexity of simple algorithms. They should be able to analyze and write computer programs using conditional and iterative structures.
Course Outline: This course covers overview of Computer Programming, Principles of Structured and Modular Programming, Overview of Structured Programming Languages, Algorithms and Problem Solving, Program Development: Analyzing Problem, Designing Algorithm/Solution, Testing Designed Solution, Translating Algorithms into Programs, Fundamental Programming Constructs, Data Types; Basics of Input and Output, Selection and Decision (If, If-Else, Nested If-Else, Switch Statement and Condition Operator), Repetition (While and For Loop, Do-While Loops), Break Statement, Continue Statement, Control Structures, Functions, Arrays, Pointers, Records, Files (Input-Output), Testing & Debugging.
Reference Material: • C++: How to Programme, Deitel and Deitel, 8th Edition, Pearson. • The Complete Reference, Herbert Schildt, Third Edition • Object Oriented Programming in C++, 3rd Edition, Robert Lafore

Course Name: Object Oriented Programming

Course Code:CC1111w

Credit Hours:4(3+1)

Prerequisites: Programming Fundamentals

Objectives:

- Students should be able to design classes using dynamic allocation of resources to solve programming problems
- Students should be able to devise member functions to solve tasks of linear complexity
- Students should be able to relate classes using concepts of inheritance to minimize duplication of code
- Correctly incorporate polymorphism concepts to amplify reusability of programming code
- Dry run OOP based code to validate its correctness
- Correctly apply OOP concepts in business problems

Course Outline : Complexity, Languages, Namespaces, Object Terminology, Objects and Classes,Encapsulation,Inheritance,Polymorphism,Modular Programming, Stages of Compilation, UnitTests, BasicConcepts, Declarations and Definitions,Scope,Prototypes and Overloading,References,Member Functions and Privacy, Member Functions,Privacy,Inlining,Input and Output Examples, OutputObjects, Input Objects,State,Dynamic Memory, Allocation and Deal location - new and delete, MemoryIssues, Encapsulation ,Classes, Constructors and Destructors, OverloadingConstructors, The Current Object,this,Classes with Resources, CopyConstructor, AssignmentOperator, MemberOperators, UnaryOperations, BinaryOperations, HelperFunctions, Independent Helpers (non-friends),Helper Operators,Friendship,Custom I/O Operators, Custom File ,Operators, Inheritance ,Derived Classes,Hierarchies,Base and Derived syntax, Access - public, protected, private Functions in a Hierarchy,Shadowing,Constructors and Destructors, Derived Classes with a Resource, Polymorphism Overview of Polymorphism,Types,Categories - coercion, overloading, inclusion, parametric, Virtual Functions

Bindings - early, late, PolymorphicObjects, Abstract Base Classes, Pure Virtual Functions, Arrays of Pointers
Unit Tests on an Interface, Function Templates,

Reference Material:

Deitel, P. J., & Deitel, H. M. (2008). C++ how to program. PearsonPrentice Hall.

Course Name: Discrete Structures

Course Code: CC1311w

Credit Hours:3(3+0)

Prerequisites:

Objectives: On completion of this course, students will be able to explain and apply the basic methods of discrete (non-continuous) mathematics in Computer Science. They will be able to reason mathematically about basic data types and structures (such as numbers, sets, graphs, and trees) used in computer algorithms and systems. They will also be able to model and analyze computational processes using analytic and combinatorial methods.

Course Outline:

Propositional Logic: Propositions, Compound Propositions, Conditional Propositions, Propositional Equivalences, Quantifiers: Universal Quantifier, Existential Quantifiers, Nested Quantifiers, Rules of Inference: Modus Ponens, Rules of Inference on Quantified Statements, Complexity of Algorithms: Growth of Functions, Complexity of Algorithms, Asymptotic Notations: Big O, Big Θ, Big Ω, Basic Structures: Sets, Subsets, Using Set notations with Quantifiers, Set operations, Computer Representation of Sets, Cardinality of Sets, Functions: One-to-One Function, Onto Function, Inverse Functions and Compositions of Functions, Graph of Functions, Sequences: Sequences, Recurrence Relations, Special Integer Sequences, Summations: Summations, Some Infinite Series, Matrices: Matrix Arithmetic, Transposes and Powers of Matrices, Zero-One Matrices, Induction: Mathematical Induction, Strong Induction and Well-Ordering, Recursion: Recursive Definitions and Structural Induction, Recursive Algorithms, Program Correctness, Counting: The Basics of Counting, The Pigeonhole Principle, Permutations and Combinations, Advanced Counting Techniques - Recurrence Relations: Applications of Recurrence Relations, Solving Linear Recurrence Relations, Divide-and-Conquer Algorithms and Recurrence Relations, Relations: Relations and Their Properties, Representing Relations, Closures of Relations, Equivalence Relations.

Reference Material:

- Discrete Mathematics and Its Applications by Kenneth H. Rosen, 7th Edition, McGraw Hill.
- Discrete Mathematics by Richard Johnsonbaugh, 7th edition, Pearson.

Course Name: Digital Logic Design
Course Code:CC2211w
Credit Hours: 4 (3+1)
Prerequisites:
Objectives: The course aims to introduce basic digital logic concepts. Understand elements of digital logic and its application to various problems in engineering. The course primarily aims to introduce the concepts of Number Systems and digital waveforms. Basic gates and logic functions. Boolean algebra, Boolean expressions. Logic minimization techniques. Combinational logic building blocks including decoders, encoders, multiplexers, DE multiplexers, magnitude comparators. Digital arithmetic, adders, subs tractors. Basics of circuits. Basic latches and flip-flops. Timing parameters and diagrams. Counters, shift registers. Binary counters and shift registers. System design with state machines. Memory devices and systems including RAM, ROM and dynamic RAM. This course includes detailed discussion on design and analysis the combinational logic circuits and synchronous sequential circuits
Course Outline: Introduction to digital logic, Number Systems and Codes .Binary storage and registers .Binary logic. Boolean Algebra. Canonical and standard forms Other logic operations. K-Map method. Product of Sum simplification. NAND, NOR and XOR Implementation. Adder and Subtract or. Analysis of Combinational Circuit. Design of Combinational Circuit. Binary multiplier. Magnitude Comparator. Combinational logic Decoders, Encoders, Multiplexer. Synchronous Sequential logic. Latches and Flip-flops. Analysis of clocked sequential circuits, State reduction and assignment. Design procedure of Sequential Circuit. Shift Registers. Ripple Counters, Synchronous counter. Memory and programming logic RAM, ROM, PLA and PAL
Reference Material: • Digital Logic and Computer Design, 3rd Edition by Morris Mano • Digital fundamentals ,10th edition by Thomas L. Floyd

Course Name: Data Structures and Algorithms
Course Code: CC2411w
Credit Hours:4(3+1)
Prerequisites: Object Oriented Paradigms
Objectives: The objective of the course is to introduce students to some of the basic data structures, abstract data types (ADTs), and related algorithms so that they can develop efficient, modular, and robust software in a cost-effective manner and study advanced data structures and algorithms.
Course Outline: Data Types and Abstract Data Types (ADTs),Introduction to Recursion, Algorithm Analysis, Lists, Stacks, Queues, Trees, Binary Search Trees (BSTs),Height-balanced BSTs, AVL Trees, AVL Tree Rotations, B-Trees, Huffman Coding, Hashing, Open Hashing, Closed Hashing, Rehashing, Extendible Hashing, Priority Queue, Min and Max Heaps, Internal Sorting, Bubble Sort, Insertion Sort, Selection Sort, Merge Sort, Heap Sort, Quick Sort, Graphs, Preliminaries and Representations, Topological Sorting, Shortest-Path Algorithms, Network Flow Problems, Spanning Trees.
Reference Material: • Introduction to Data Structures and Algorithm with C++ by Glenn W. Rowe, 4th Edition, Prentice Hall Publications, 2000. • The C++ Programming Language by BjarneStroupstrup, 3rd Edition, Addison Wesley Publications, 1988.

Course Name: Introduction to Database Systems
Course Code: CC2421
Credit Hours:4(3+1)
Prerequisites: Data Structure and Algorithms
Objectives: The course aims to introduce basic database concepts, different data models, data storage, retrieval and database design techniques. The course primarily aims to introduce the concepts of relational data model and Database Management Systems (DBMS).This course includes detailed discussion on various features of Databases such as Architecture, ER Model, Relational Model, Normalization, Indexing and introduction to SQL and its practical use. It will also include practical demonstration and use of a commercial database packages.
Course Outline: Introduction and Overview, Entity Relationship (ER) Model, Entity, Entity Instance, Types of Entities, Strong versus Weak Entity, Super Types and Subtypes, Types of Attributes, Simple and Composite Attributes, Stored and Derived Attributes, Multi-valued Attributes, Mapping, Regular Entities, Weak Entities, Composite Attribute, Multi-valued Attribute, Associative Entity, Resolving Multi-valued Attributes, Unary, Binary and Ternary-to-N relationships, Cardinality constraints, One-to-One, One-to-Many, Many-to-Many, Enhanced Entity Relationship Model(EER)Super type and Subtype Relationship, Relational Model Concepts, Constraints and Algebra, ER and EER-to-Relational Mapping, Relational Algebra, Relational Operators and its forms, Relational Operations, SQL, Data Definition Language(DDL), Data Manipulation Language(DML), Functional Dependencies(FDs), Normalization, and Further Dependencies, Closure Set, Minimal Cover, Equivalent Set, Steps in Normalization, Repeating Groups, Dependency, Functional Dependencies, Partial Dependencies, Database Security and Authorization, Small Group Project implementing a database.
Reference Material: • Fundamentals of Database Systems by RamezElmasri, 6th Edition, Addison Wesley Publications, 2009. • An Introduction to Database Systems by Christopher J. Date, 7thEdition, Addison Wesley Publications, 2007. • Distributed Systems, Concepts and Design by George Coulouris, Dollimore and Kindberg, 4th Edition, Addison Wesley Publications, 2005.

Course Name: Software Engineering
Course Code:CC2711
Credit Hours: 3(3+0)
Prerequisites: N/A
Objectives: The objective of this course is to familiarize students with fundamental software engineering concepts and provide guidelines on various software development models and phases of software development life cycle. There are four principle aims of the course, to convey the importance and need of software engineering; to discuss different software development models appropriate for the development and maintenance of software products; to introduce the basic project management concepts for the development of a high-quality product; to impart comprehensive knowledge regarding software development lifecycle.
Course Outline: Introduction to Software Engineering, The Nature of Software, Software Realities, The Software Process, Software Principles, Software Myths, The Software Process, Generic Process Model, Process Assessment and Improvement, Prescriptive Process Models, The Waterfall Model, Incremental Process Models, Evolutionary Process Models, Concurrent Models, Specialized Process Models, Component-Based Development, The Formal Methods Model, Aspect-Oriented Software Development, The Unified Process, Personal and Team Process Models – PSP and TSP, Process Technology, Agile Development, Agile Process, Agility Principles, Extreme Programming (XP), Other Agile Process Models, Adaptive Software Development (ASD), Scrum, Dynamic Systems Development Method (DSDM), Crystal, Feature Driven Development (FDD), Lean Software Development (LSD), Agile Modeling (AM), Agile Unified Process (AUP), Tool Set for the Agile Process, Requirement Modeling, Requirements Analysis, Scenario-Based Modeling, Use Case, Activity Diagram, SwimlaneDiagrams, Data Modeling Concepts, Data Objects and Attributes, Relationships, Class-Based Modeling, Class-Responsibility-Collaborator (CRC) Modeling, Associations and Dependencies, Flow-Oriented Modeling, Data Flow Model, Control Flow Model, Creating a Behavioral Model, State Representations
Reference Material: • Software Engineering-A Practitioner's Approach, 5th Ed, Roger S. Pressman.

Course Name: Operating Systems
Course Code: CC3021w
Credit Hours:4(3+1)
Prerequisites: Data Structure and Computer Organization
Objectives: Understand the basic structure and organization of a multi-programmed computer system, including the distinction between user and kernel mode, the use of interrupts and context switches, runtime organization, application-binary interfaces and system calls, program linking and loading. Understand the principles underlying concurrency and know how to use proper synchronization and deadlock avoidance techniques. Understand the principles behind memory management, including user-level memory management, virtual memory management and paging. Understand the principles behind CPU scheduling, including round-robin, priority-based, and multi-level feedback queue based scheduling algorithms. Understand how an OS provides protection to its applications and how it manages and virtualizes resources.
Course Outline: SE 325 provides an in-depth introduction to the principles and practices of operating systems. Particular emphasis is given to the topics of multiprogramming, process and thread management, memory management, including virtual memory, concurrency, including synchronization and deadlock, resource allocation and management, including scheduling, and storage management and file systems. Additional topics include inter-process communication, networking, and device management. We will be looking OS from inside as well as from User point of view i.e. how different utility applications can bring a more clearer picture of what is happening inside the OS .
Reference Material: AbrahamSilberschatz, Galvin, Gagne. Operating System Concepts.9th Edition. *Optional reference:* • William Stallings. Operating Systems: Internals and Design Principles. 8th Edition

Course Name: Computer Communication Networks
Course Code: CC3611w
Credit Hours: 4 (3+1)
Prerequisites: Structure Programming
Objectives: The course aims to introduce fundamental concepts of computer networking in students. The students are required to get detail knowledge of different protocols in use in computer networks. Also, students should get expertise in socket programming so that they can develop network applications of practical use.
Course Outline: Introduction and Overview, Review of different fundamental concepts, Socket Programming (in UNIX and Windows), Transport-Layer Protocols design and operation, Network Security (concepts and issues).
Reference Material: • "Computer Networking: A Top-Down Approach (6th Edition)", James F. Kurose, Keith W. Ross, Addison Wesley Publications, 2013.. • "Data and Computer Communications (8th Edition)", Addison Wesley Publications, 2007.

Course Name: Human Computer Interaction

Course Code: CC3041w

Credit Hours: 3(3+0)

Prerequisites: NA

Objectives: Human Computer Interactions (HCI) is concerned with designing, evaluating and deploying usable, effective technologies in a range of contexts - be it home, office, school, cyberspace or other domain. The objective of this course is to give an introduction to the key areas, approaches and developments in the field. The main objective is to get student to think constructively and analytically about how to design and evaluate interactive technologies. Basically, the course will introduce them to key areas, theoretical frameworks, approaches and major developments in HCI.

Course Outline: What is Interaction, Interaction design and human computer interaction, good and bad design, understanding user needs, evolution of HCI interfaces, relationship between interaction design, HCI and other fields, ergonomics, usability goals, user experience goals, design principles, Human Perception, Ergonomics, Cognition, and Psychology, need to understand users, cognitive aspects and their design implications, mental models, implementation and designer models, gulf of execution and gulf evaluation, distributed cognition, externalization and computational offloading, the process of interaction design, basic activities, key characteristics, practical issues, user centered approach, beginner experts and intermediates, interaction design life cycle model, usability engineering life cycle model, establishing requirements, kind of requirements, personas and user profiles, qualitative and quantitative research, data gathering techniques and guidelines, requirement documenting techniques, types of personas, cognitive processing and user goals, design implications, design prototyping and construction, user centered approach to interaction design, evaluation and its types, usability testing, evaluation framework, evaluation paradigms, platform and posture, types of platforms and postures, flow and orchestration and guidelines, excise and its types, guidelines and reducing navigations, undo and redo.

Reference Material:

- About Face 3.0, the Essential of Interaction Design by Alan Cooper, Robert Reirmann, David Cronin, Wiley.
- Interaction Design beyond Human Computer Interaction by Jenny Preece, Yvonne Rogers and Helen Sharp, 3rd edition, Wiley and sons Inc., April 2011.
- The Usability Engineering Lifecycle A Practitioner's Handbook for User Interface Design by Deborah Mayhew, Elsevier, March 1999.

7.2 Program Core

Course Name: Software Engineering
Course Code:CC2711
Credit Hours: 3(3+0)
Prerequisites: N/A
Objectives: The objective of this course is to familiarize students with fundamental software engineering concepts and provide guidelines on various software development models and phases of software development life cycle. There are four principle aims of the course, to convey the importance and need of software engineering; to discuss different software development models appropriate for the development and maintenance of software products; to introduce the basic project management concepts for the development of a high-quality product; to impart comprehensive knowledge regarding software development lifecycle.
Course Outline: Introduction to Software Engineering, The Nature of Software, Software Realities, The Software Process, Software Principles, Software Myths, The Software Process, Generic Process Model, Process Assessment and Improvement, Prescriptive Process Models, The Waterfall Model, Incremental Process Models, Evolutionary Process Models, Concurrent Models, Specialized Process Models, Component-Based Development, The Formal Methods Model, Aspect-Oriented Software Development, The Unified Process, Personal and Team Process Models – PSP and TSP, Process Technology, Agile Development, Agile Process, Agility Principles, Extreme Programming (XP), Other Agile Process Models, Adaptive Software Development (ASD), Scrum, Dynamic Systems Development Method (DSDM), Crystal, Feature Driven Development (FDD), Lean Software Development (LSD), Agile Modeling (AM), Agile Unified Process (AUP), Tool Set for the Agile Process, Requirement Modeling, Requirements Analysis, Scenario-Based Modeling, Use Case, Activity Diagram, SwimlaneDiagrams, Data Modeling Concepts, Data Objects and Attributes, Relationships, Class-Based Modeling, Class-Responsibility-Collaborator (CRC) Modeling, Associations and Dependencies, Flow-Oriented Modeling, Data Flow Model, Control Flow Model, Creating a Behavioral Model, State Representations
Reference Material: • Software Engineering-A Practitioner's Approach, 5th Ed, Roger S. Pressman.

Course Name: Object Oriented Software Engineering **(**Software Construction)
Course Code:SE3721w
Credit Hours: 4(3+1)
Prerequisites: Object Oriented Programming
Objectives: The course aims to introduce the concepts of Object Oriented Programming in java, importance of classes and objects, Write Object Oriented Code in java, Identify classes and their relations and code them, Think Object Oriented, Learn the concepts of GUI based designing, Create event-driven GUI using Java technology GUI components: panels, buttons, labels, text fields, and text, Understand and apply the different common practices used in software industry for the analysis, design and production of software. It will also include the analysis, design and implementation of practical systems of up to average complexity within a team and familiarity with different tools used by industry in the software development process.
Course Outline: Introduction to java, Intro to IDE, Installation & Environment Set up, Introduction to Java, Revisited programming concept in javaScope (Public, Private, Protected, Default), Classes and Objects, Constructors, Method Overloading, Polymorphism, Class as Data Type, Getters and Setters, Arrays of Objects, Accessing Methods defined in other classes, Wrapper classes, Packages, OOP Concepts – Encapsulation, Inheritance, Supper class, Sub class, OOP in Java – Inheritance, Abstract super classes, Interfaces, Inner classes, Packages, Aggregation, Composition, Exception Handling (Try – Catch – Final – Throw), File Handling in Java, Building GUIs with Swing. Components, Events and Event Handling / Layout, Code Refracting, Code Reusability, Design Pattern, Intro to Web Programming, Servlets, JSP's
Reference Material: • Java How to Program By DietelDietel • Introduction to Java Programming by Y.Daniel Liang • Big Java by Cay Horstmann

Course Name: Software Requirement and Specifications
Course Code:SE3731w
Credit Hours: 3(3+0)
Prerequisites: Software Engineering
Objectives: The intent of this course is to familiarize students with the elicitation, analysis, modeling and specification of software engineering requirements. There are three principle objectives, to understand the basics of requirements engineering; elicitation, traceability, documentation; to understand the importance of stakeholders and their knowledge, context and goals; to understand the challenges involved in requirements engineering.
Course Outline: Introduction to Requirements, Introduction to Systems Engineering., Defining Requirements Engineering, Requirements and Quality, Requirements and the Lifecycle, Requirements Tracing, Requirements and Modeling, Requirements and Testing, Requirements in the Problem and Solution Domains, Developing Systems, Generic Process Context, Input Requirements and Derived Requirements, Acceptance Criteria and Qualification Strategy, Generic Process Introduction, Ideal Development, Development in the Context of Change, Generic Process Information Model, Information Classes, Agreement State, Qualification State, Satisfaction State, Information Model Constraints, Generic Process Details, Agreement Process, Analyze and Model, Deriving Requirements, Deriving the Qualification Strategy, Representations for Requirements Engineering, Data Flow Diagrams, Entity-Relationship Diagrams, State charts, Object-Oriented Approaches, Class Diagrams, Use Cases, Viewpoint Methods, Controlled Requirements Expression, Structured Analysis and Design Technique, Viewpoint-Oriented Requirements Definition, Object-Oriented Methods, Object-Oriented Analysis, OMT, Booch, Objectory, UML Notation, Formal Methods, Z–A Model-Based Formal Method, Requirements for Requirements, Structuring Requirements Documents, Key Requirements, Using Attributes, Ensuring Consistency Across Requirements, Value of a Requirement, The Language of Requirements, Requirement Boilerplates, Granularity of Requirements, Criteria for Writing Requirements Statements, Agree Requirements with Customer, Analyze & Model, Identify Stakeholders, Create Use Scenarios, Derive Requirements, Define Structure.
Reference Material: • Requirements Engineering, 3rd ed., Elizabeth H., Ken J. and Jeremy D.

Course Name: Software Verification and Validation
Course Code:SE3741w
Credit Hours: 3(3+0)
Prerequisites: Software Engineering
Objectives: Students will learn to incorporate quality into software developments process. They will be taught to test software as it is being analyse , designed or developed. Learning to develop ranking and severity criteria of bugs will also be a core objective of this course. Usage of a bug tracking system will also be taught along the way. Moreover, students will learn how automating some of the testing can make the QA process more efficient and objective. In the end, will be able to better understand the overall health of their software product, and ensure quality goals are being met.
Course Outline: General Introduction to Software Testing, Software Testing with respect to different software development processes and relevant factors (e.g. risk, cost, etc.). Functionality coverage.Requirements partitioning. Experimental design. Choosing test inputs, input coverage testing. Exhaustive testing. Input partitioning. Shotgun testing. Input partition/shotgun hybrid. Robustness testing. Boundary testing, .Gray box testing. Black box unit testing. Test harnesses and stubs. Assertions in test automation, tools. Black box class testing (interface / object oriented testing). Traces. Implementingassertions. Black box integration testing. Functional testing, model-based testing i.e. coverage criteria and test cases generated from relevant software models like, e.g., control flow graphs, finite state machines and grammars. the basic concepts of structural testing, basic structural coverage criteria: Statement Coverage, Branch Coverage, Condition Coverage and Path Coverage.
Reference Material: Software Testing: A Craftsman's Approach, Fourth Edition -by Paul C. Jorgensen

Course Name: Software Architecture and Design
Course Code:SE3751w
Credit Hours: 3(3+0)
Prerequisites: NA
Objectives: For decades, software architecture has received primary focus in the field of software engineering. With the growth of the software industry, it has become clear that an early and careful architectural design can greatly reduce the failure rates of software projects. A good architectural design partitions the functional requirements of a software system into a manageable set of interacting elements. Quality attributes such as efficiency, usability, modifiability, reliability, and security can be verified and estimated with respect to the design before any code is produced. As the blueprint of a software system, the architectural design allows system analysts and software architects to communicate effectively with one another and with other stakeholders. It also sets the foundation for the subsequent design and development processes. The detailed design process furnishes the specifics of each architectural element, which can then be implemented via coding, followed by debugging, testing, and maintenance. All of these software development activities greatly benefit from an architectural design that clearly depicts the structure of the software being built.
Course Outline: Introduction to Software Architecture, , relationship between software requirements and architecture, relationship between architecture styles and architecture, elements of software architecture, Software Architecture Design Space, structures used in, software architecture, major element and connector types, Models for Software Architecture, UML notations as modeling tools, Data Flow Architectures, concepts of data flow architectures, data flow architecture in UML, application domains of the data flow architecture, benefits and limitations of the data flow architecture approach, batch sequential and pipe and filter architectures, Data-Centered Software Architecture, concepts of data-centered software architecture, repository and blackboard architectures, applicable domains for data-centered software architecture, benefits and limitations of data-centered software architecture.
Reference Material: • Software Architecture and Design Illuminated by Kai Qian, Chong-weiXu, Xiang Fu, Jorge L. Díaz-Herrera, Lixin Ta, Jones and Bartlet Publishers, 2010 • Software engineering A practitioner's Approach by Roget S Pressman, McGraw Hill, 2010.

Course Name: Software Project Management
Course Code:SE3761w
Credit Hours: 3(3+0)
Prerequisites: Software Engineering
Objectives: The objective of this course is to familiarize students with fundamental project management concepts and provide guidelines for successful project management. The course will cover various areas and basic methods related to managing software projects. There are two principle aims, to understand the fundamental principles of Software Project Management and have a good knowledge about the responsibilities of a project manager; to provide familiarity with the different methods and techniques used for Software Project Management.
Course Outline: Introduction to Software Project Management, Why Projects Fail, How to Make them Successful, Role of a Project Manager, The Management Spectrum; The People; The Stakeholders; Team Leaders; Software Team; Agile Team; The Product; Scope; Problem Decomposition; The Process; The Project, W5HH Principle, Project Needs, Project Scope, Problem Statement, Project Vision, Project Plan, Statement of Work, Project Schedule, Work Break Down Structure, Risk Plan, Planning Problems, Successful Estimations, Wideband Delphi Estimation, Other Estimation Techniques, Estimation Problems, Project Scheduling, Resource Allocation, Dependencies, Gantt Chart, Schedule Reviews, Schedule Optimization, Slack, Buffer, Critical Path, Managing Slipped Schedule, Managing Multiple Projects, Prioritization, Scheduling Problems, Inspections, Inspection Logs, Deskchecks, Walkthroughs, Code Reviews, Pair Programming, Review Problems
Reference Material: • Applied Software Project Management, 2005, Andrew Stellman and Jennifer Greene. • Software Engineering-A Practitioner's Approach, 7th Ed, Roger S. Pressman. • People ware Productive Projects and Teams, 2nd edition, Tom DeMarco and Timothy Lister.

7.3 Supporting Core

Course Name: Calculus 1
Course Code: MA100
Credit Hours: 3(3+0)
Prerequisites: -
Objectives: • To be able to learn the concept of a limit and continuity of a function and apply it upon various polynomial, root, trigonometric, logarithmic and exponential functions. • To grasp the concept of derivative of a function and applying different techniques to differentiate and optimize various functions. • To find an indefinite integral of a given function and to be able to apply it for finding the areas between the curves and finding the volumes.
Course Outline: MA 100 is a one-semester three credit-hours course. This is the first course on Calculus. Starting from the notion of functions, we will develop the basic concepts of mathematical analysis, the limit, the derivative and the integral. Several computational tools will be covered as well. A tentative schedule of lectures is given on this web site.
Reference Material: M.D. Weir, J. Hass & F.R. Giordano. *Thomas' Calculus*, Pearson Education, latest edition

Course Name	Basic Electronics
Course Code	CS2201
Credit Hours	4 (3+1)
Pre-requisites	This course deals with the introduction and application of semiconductor devices used in various electronic circuits. Purpose of this course in Energy Engineering is to provide a focused interdisciplinary experience for undergraduates that encompass important elements from traditional courses as well as contemporary developments in electronics and computer sciences.
Course Description	• Semiconductor Diodes and Diode Applications • Bipolar Junction Transistors, BJT DC Biasing • Field Effect Transistors, FET Biasing • Operational Amplifiers, OP-AMP applications • Power Supplies • Kirchhoff's Laws • Other two-terminal devices • PNPN and other devices
Expected Outcomes	Upon completion of this curse, students will have a good knowledge: 1. Of characteristics and utilization of various modern electronic components and different parameters that can affect their performance. 2. To devise an electronic system for collecting different information about processes and select appropriate devices for electronic system design.
Text Books	Electronic Devices by Floyd (7^{th} edition, or any one available)
Reference Books	Electronic Devices and Circuits Theory by Robert L. Boylestad (8^{th} edition)
Grading Policy	Quiz Total Marks = 20 marks Attendance + Class Participation = 5 marks Mid Term = 25 marks Final Term = 50 marks Ratio may change.

Course Name: Linear Algebra
Course Code: MA210
Credit Hours: 3(3+0)
Prerequisites: - Calculus ll
Objectives: In accordance with HEC curriculum 2014, students at the end of the course should be able to • To be able to express a system of equations in matrix form and solve by different methods. • To be fully familiar with vectors in two and three dimensions and their properties. • To understand the concept of a vector space and its various models. • To have a clear notion of a linear transformation and its applications
Course Outline: An introduction to the algebra and geometry of vector spaces and matrices, this course stresses important mathematical concepts and tools used in advanced mathematics, Computer Science, Physics and Economics. A systematic method of solving systems of linear equations is the underlying theme and applications of the theory will be emphasized. Topics of exploration include Gaussian elimination, determinants, linear transformations, equations of line and plane. Conference time will be allocated to clarifying course ideas and exploring additional applications of Linear Algebra. This course directly contributes to **objectives** of the HEC Electrical Engineering Curriculum 2014.

Course Name: Probability and Statistics
Course Code: MA150
Credit Hours:3(3+0)
Prerequisites: Calculus ll
Objectives: • The student should be able to understand the basic concepts and terms of Statistics
Course Outline: • Understanding the application of Statistics in the different fields • Knowledge of Probability and Using Probability in the concerned field • Decision making for proper management
Reference Material: Ronald Walpole, Myers, Myers, Ye, "Probability & Statistics for Engineers & Scientists", 8th edition, 2008, **Prentice Hall** Publisher, Introduction to Statistical Theory by Prof. Sher Muhammad Chaudhry Prof. Dr.Shahid Kamal, Publisher: ILMI KitabKhana

7.4 University Core

Course Name: Professional Practice
Credit Hours: 3 (3+0)
Prerequisites: None
Objectives: After studying this course the students should be able to, understand different kinds of behaviors within the working organizations. It can help them in identifying and managing conflict and frustration in their personal and professional lives. They can apply different motivational techniques to boost the performance of employees working in different spheres. They can select tactics for balancing the demands of work and personal life. It can also help them to improve their problem solving and decision making skills. They will know how to appear in an Interview confidentially and how to design an impressive CV. Some of the important business ethics, etiquettes and manners will also be re-emphasized in this course.
Course Outline: Introduction to Professional Practice, Management Functions, Challenges and Opportunities for Organizations, Historical, Social, and Economic context of Computing, Definitions of Computing (Software Engineering, Computer Science, Information Technology) Research Methodology, Communication, Functions of Communication, Communication Process, Resumes and Job Letters, Designing the letter of application and an effective resume, Human Resource Policies and Practices, How to appear effectively in an interview, The Dos and Don'ts of an Interview, Body Language during Interview, Organizational Change and Stress Management, Building Relationships with Superiors and Co-Workers, Adjusting to the Organizations, Standards of Dress and Appearance, Etiquettes and Manners in Professional Organizations.
Reference Material: • Organizational Behavior by Stephen P Robbins and Seema Sanghi, 13th Edition**,** Pearson Education India Publications, 2005. • Technical Writing and Professional Communication by Thomas N. Huckin and Leslie A. Olsen, 2nd Edition**,** McGraw-Hill Humanities/Social Sciences/Langua Publications, 1991. • Effective Project Management, 2/E, Robert K. Wysocki, Wiley Computer Publishing, Year 2006.

Course Name: English I

Course Code: EN110

Credit Hours: 2(2+0)

Prerequisites: -

Objectives:

- Compose sentences effectively into paragraphs and paragraphs into essays
- Understand the patterns of narrative and descriptive writing styles with attention to grammar, syntax, content and organizational structure
- Critically read and analyze a text
- Engage in topic relevant discussions with peers drawing on a wide range of information sources and experiences
- Develop good communication and presentation skills by actively participating in class discussion
- Give formal presentations and confidently participate in discussions
- Skim and scan the text of newspapers and magazines
- Comprehend the elements of comparison and contrast in written material to develop essays of about five paragraphs

Course Outline: This course is the first in a series of three required English language courses designed to promote English language proficiency at undergraduate level for students belonging to School of Science and Technology. We will focus on four language skills (reading, listening, writing, and speaking) using variety of texts (traditional textbook lessons, online material, contemporary newspaper and magazine articles, films, and documentaries) with particular emphasis on grammar, vocabulary, and spoken fluency. Starting with thesis statement and paragraph development we will progressively move on to activities and exercises illustrating the concepts of (a) narration, (b) description, (c) comparison and contrast, and (d) cause and effect. The core skills will be incorporated in the classroom to facilitate the learner to acquire the target results and enhance their interpersonal skills. By the end of course learner should be able to demonstrate the improvement of your English usage within appropriate contexts (academic, social, personal, work related).

Reference Material:

- Brandon, Lee.(2004). Paragraphs and Essays:a*worktext* with Readings.New York, N Y:st Antonio college pub.
- Fishes. Marjorie,westheimer, Miriam,. Bonner, Margaret.(2006).Longman series for Grammarian intermediate course for reference and practice.NewYork,NY:longman pub.
- How,D,& Kirkpatrick,T.A,.Kirkpatrick,D.L.(1993).English for Undergraduates.London:oxford university press.
- Rosa, A &Eschholz, P.(eds).(2002).Models for Writers.short essays for Composition.Newyork NY: stMartins press.

Course Name: English II

Course Code: EN112

Credit Hours: 2(2+0)

Prerequisites: English I

Objectives: After the successful completion of this course students will:

- Practice effective listening as 25% of the activities will be allocated to listening.
- a range of reading and writing activities will be provided so that students will present and write personal, expository and persuasive/argumentative essays effectively in both written and oral communication
- demonstrate excellent comprehension skills in presentations and written work
- present an successful personal statement
- give excellent formal and informal presentations
- exhibit skills of proposal writing
- demonstrate proficiency in English grammar and composition

Course Outline

This course is designed to improve and polish the communication skills through **listening, speaking, reading and writing**. Documentaries, Movie clips, Motion pictures, online and book resources for grammar exercises, articles from major national and international newspapers (Express Herald Tribune, Dawn etc.) are included to emphasize **personal and reflective, expository, analytical, argumentative** writing that forms the basis for academic and professional communication. It fosters the development of writing faculty in any context. In addition, this course incorporates the proper utilization of critical observation and analytical thinking through **formal and informal presentations** also. Students are motivated to place a high emphasis on content, purpose, audience and overall coherence patterns.

Reference Material:

- Specific handouts along with exercises.
- Articles from the internet and other sources.
- **Documentaries:**

Movies:

- Collins, C. Owen, A.(Producers), &Gabron, S.(Director).(2008) *Brick Lane* [Motion Pictures].UK: London studio
- Spacey, K, Ratner, B.et.al (Producers), &Luketic, R (Director).(2008) *Twenty One* [Motion Pictures]. Relativity Media ,Trigger Street Productions studio

Recommended readings:

1. Ali, Ahmad. (1974). Twilight in Delhi. New York : Directions publishing co-operations
2. Rodriguez, Richard. (1981) Aria.
3. Ali,Monica.(2004). Brick Lane . UK: Scriber

Course Name: Islamic Studies

Course Code: HM150

Credit Hours: 2(2+0)

Prerequisites: -

Objectives:

Through the teachings of the Qur'an and Sunnah, this course will prepare the students to modify their personality according to the teachings of Islam.

Course Outline:

Acquired traits in a personality exert a powerful influence on human destiny-collective and individual. While a constructive attitude can propel mankind to progress and prosper in life here and life-hereafter, a destructive personality can destroy the very foundations of society. Personality development being so crucial to the health of a society, it is sad that most of us are letting our personality shapes up by itself. This course is a conscious effort for devilment of personality.

The Muslim, as Islâm meant him to be, is a unique and remarkable person in his attitude and conducts and in his relationships and dealings with others at all levels. Throughout history, man has never been given the components of a virtuous and integrated personality as Islâm has blessed Muslims with, through the divine guidance contained in the Qur'ân and Sunnah.

Reference Material:

- Ahmad Von Denffer, Ulum al- Qur'an, An Introduction to the Sciences of the Qur'an, Chapter: 1 The Qur'an and the Revelation, p 11-29
- M.M. Azmi, The History of the Qur'anic Text : from Revelation to Compilation, Ch: 6,7 The Written Compilation of the Qur'an, Uthman'sMushaf p: 77-96
- Windows on the House of Islam: Muslim Sources on Spirituality and Religious Life, edited by: John Renard," Varieties of Qur'an Interpretations, pp 35-40 (IbnTaymiya "Treatise on the Principles of Tafsir)
- Sachiko Murata & William C. Chittick, The Visions of Islam, pp: xxv-xxxii, 3-7
- The Meaning of the Qur'an, S. AbulA'laMaududi
- Ihyaululum, Imam Ghazali, trans. (Vices)
- QadiIyad, Muhammad the Messenger of Allah (SAW), Ash- Shifa, On the Necessity of Loving the Prophet (S.A.W)
- Tariq Ramadan, the Messenger; the Meaning of the Life of Muhammad, pp 211-216 in history of eternity.

Course Name: Pakistan Studies

Course Code: SS171

Credit Hours: 2(2+0) **Prerequisites: -**

Objectives: This course has been design to develop a more balanced interdisciplinary approach to the study of Pakistan, with particular reference to modern developments. In order to create awareness among the students about the "Vision of Pakistan", as given by our leaders during the freedom movement and after the emergence of Pakistan, the rationale of Pakistan's creation is highlighted. This approach will, hopefully, bring an element of objectivity in explaining the creation of Pakistan, nature of the civil society and social interaction among the provinces of Pakistan. The selected readings will also be helpful to create consciousness among the students about the nature of the state of Pakistan as envisioned by Quaid-i-Azam and his descendants. This approach will also be useful in educating the students about the taxonomy of the state and in motivating them to develop a sense of patriotism as well as an urge for creative reconstruction regarding external affairs of Pakistan.

Course Outline: This course has been design to develop a more balanced interdisciplinary approach to the study of Pakistan, with particular reference to modern developments. In order to create awareness among the students about the "Vision of Pakistan", as given by our leaders during the freedom movement and after the emergence of Pakistan, the rationale of Pakistan's creation is highlighted. This approach will, hopefully, bring an element of objectivity in explaining the creation of Pakistan, nature of the civil society and social interaction among the provinces of Pakistan. The selected readings will also be helpful to create consciousness among the students about the nature of the state of Pakistan as envisioned by Quaid-i-Azam and his descendants. This approach will also be useful in educating the students about the taxonomy of the state and in motivating them to develop a sense of patriotism as well as an urge for creative reconstruction regarding external affairs of Pakistan

Reference Material:

1- Afzal, M. Rafique. *Political Parties in Pakistan, 1947-1958*. Islamabad: National Commission on Historica and Cultural Research, 1976.
2- Ahmad, Aziz. *An Intellectual History of Islam in India*. Chicago: Aldine, 1969.
3- Ahmed, Akbar S. *Pakistan Society: Ethnicity and Religious*
4- Ayub Khan, Mohammad. *Friends Not Masters: A Political Autobiography*. New York: Oxford University Press, 1967.
5- Aziz, K.K. *Party Politics in Pakistan, 1947-1958*. Islamabad: National Commission on Historical and Cultural Research, 1976.
6- Aziz, K.K. *The Making of Pakistan: A Study in Nationalism*. London: Chatto and Windus, 1967.
7- Burke, S.M. *Pakistan's Foreign Policy: An Historical Analysis*. London: Oxford University Press, 1973.
8- Choudhury, G.W. *Constitutional Development in Pakistan*. (2d ed.) Vancouver: Publications Centre, University of British Columbia, 1969.
9- Francis Robinson, *Islam and Muslim History in South Asia*, London: Oxford University Press
10- Hodson, H.V. *The Great Divide: Britain, India, Pakistan*. London: Hutchinson, 1969.

Course Name: English III

Course Code:EN201

Credit Hours: 2(2+0)

Prerequisites: EN112

Objectives: By the end of the course students should be able to:

- Communicate effectively both verbally and non-verbally
- Apply the required academic communication skills in different other forms of academic writing
- Demonstrate understanding of the generic fundamentals of communication: interpersonal skills and critical thinking
- Use various computer-mediated communication platforms in their academic and professional work

Course Outline: The course will focus on the development of language skills on an advanced level as students have already attended English II. The course is designed on the basis of the communication needs of SST department so more emphasis is given to the oral and written communication. A range of activities are designed to address the language skills required for the academic and professional life of students. Students will be provided with a resources pack and on line links to facilitate their learning inside and outside the class. Students will be expected to search blogs and journals for class assignments and presentation. Students will be expected to presents and write on the following areas: repot writing, effective communication both written and oral, cover letter writing, writing for blogs and newspapers, writing reviews on books and movies. Language skills of the students will be polished by providing them exposure to the activities and tasks which will be carried out inside and outside classrooms. Communicative language teaching approach will be the basis for teaching this course. This course is designed to expose students to the fundamentals of academic and professional communication in order to develop professional skills.

Reference Material:

- The Mayfield Handbook for Technical Writing http://www.mhhe.com/mayfieldpub/tsw/home.htm
- Business Communication Today by Bovee, C.L. &Thill, J.V.
- *Crystal, D. (2005).English and the Communication of Science.* Paper for the English-Speaking Union Science Conference (centenary issue) pp.20-33. Zimmerman, F. (1992). *English for Science.* London: Prentice Hall Regents
- Armer, T. (2009). *Cambridge English for Scientists.* Cambridge: Cambridge University Press
- **Barrass, Robert, S*cientists Must Write* 2nd ed. (London; Routledge, 2002).** Two very thorough chapters on writing reports, with checklists and tips on layout. Includes explanations of graphical data, and chapters on writing style.

7.5 Program Electives

Course Name: Visual Programming
Credit Hours:3(3+0)
Prerequisites: None
Objectives: In this course it will be emphasized: to introduce the message driven architecture of windows operating system, to provide the students an introduction of class hierarchy of MFC frameworks, to study various resources provided by windows operating system and to be able to program quality applications for windows based systems.
Course Outline: The Windows Programming Model, More About Messages, Windows Programming, SDK-Style, Introducing MFC, Benefits of Using C++ and MFC, MFC Design Philosophy, Document/View Architecture, MFC Class Hierarchy, *Afx* Functions, MFC Applications, The Application Object, How MFC Uses the Application Object, The Window Object, Message Map, Drawing with the GDI, The MFC Device Context Classes, GDI Pens and the *CPen* Class, GDI Brushes and the *CBrush* Class, Deleting Pens and Brushes, Seeing What You've Drawn, Adding a Scroll Bar to a Window, Setting a Scroll Bar's Range, Position, and Page Size, Processing Scroll Bar Messages, Scrolling the Contents of a Window, Scrolling Text and Images, The *CScrollView* Class, Loose Ends, Input Devices (Mouse and the Keyboard), Getting Input from the Mouse, Client-Area Mouse Messages, Nonclient-Area Mouse Messages, Capturing the Mouse, Mouse Capturing in Action, The Cursor, Mouse Miscellanea, Getting Input from the Keyboard, Keystroke Messages, Character Messages, The Caret, The VisualKB Application, Handling the Caret.
Reference Material: • Windows Internals by Alex Ionescu, David A. SolomonandMark E. Russinovich, 5th Edition, O'Reilly Publications, 2009. • Programming Windows 98 by Charles Petzold, 5th Edition, Microsoft Press Publications, 1998. • Programming Windows with MFC by Jeff Prosise, 2nd Edition, Microsoft Press Publications, 1999.

Course Name: Fuzzy Logic
Credit Hours: 3 (3+0)
Prerequisites: None
Objectives: This course is an introduction to fuzzy logic and fuzzy set theory. Topics will include the mathematical foundations of fuzzy sets, properties of fuzzy systems and fuzzy logic applied to the design of intelligent systems and for intelligent control, adaptive fuzzy systems, etc.
Course Outline: Concept of Fuzziness, Mathematical Modeling, Operations on Fuzzy Sets, Fuzziness as Uncertainty, Boolean Algebra and Lattices, Equivalence Relations and Partitions, Composing Mapping, Isomorphism and Homomorphism, Alpha-cuts, Images of Alpha-level Sets, Fuzzy Quantities, Fuzzy Numbers, Fuzzy Intervals, Classical Two-Valued Logic, A Three-Valued Logic, Fuzzy Logic, Fuzzy and Lukasiewicz Logics, Interval Valued Fuzzy Logic, Canonical Forms, T-norms, Generations of T-norms, Isomorphism of T-norms, Negations, Nilpotent T-norms and Negations, De Morgan System, Groups and T-norms, Interval Valued Fuzzy Sets, Definition and Examples, Binary Fuzzy Relations, Operations on Fuzzy Relations, Fuzzy Relation as Chu Spaces, Additive and Non Additive Set Functions, Possibility, Possibility Theory based on Fuzzy Sets, Approximate Reasoning, Approximate Reasoning in Expert Systems, Fuzzy Models and Control, Methodology and Fuzzy Control, Optima Fuzzy control, Analysis of Fuzzy Control Techniques.
Reference Material: • A First Course in Fuzzy Logic by Hung T. Nouven and Elbert A. Walker, 3rd Edition, Chapman and Hall Publications, 2005. • An Introduction to Fuzzy Logic for Practical Applications by Kazuo Tanaka and Niimura, 1st Edition, Springer Publications, 1996. • Fuzzy Set Theory, Foundations and Applications by George J. Klir, Ute S. Clair and Bo Yuan,1st Edition, Prentice Hall Publications, 1997.

Course Name: Rapid Application Development
Credit Hours: 3 (3+0)
Prerequisites: None
Objectives: Applications of RAD approach to computer software design and development, life cycle models, visual programming, using 4th generation software development tools. Conceptual model design and detailed design through components. Reusability through component-based software model.
Course Outline: Rapid Application Development (RAD) Process Model, RAD Principles, RAD in the Software Development Process, RAD and Prototyping, Horizontal vs Vertical Prototyping, Rapid Prototyping, The Visual Programming Paradigm, Windows Architecture, Class Hierarchy, Component-Based Development, In Process and Out of Process Components, Objects, Events, Event Handling, Object Reuse, Introduction to Commonly Used Visual Tools for Rapid Application Development, Case Studies using Visual Tools.
Reference Material: • Programming Windows Identity Foundation by Vittorio Bertocci, 1st Edition, Microsoft Press, 2010. • Programming for Windows using MFC by Jeff Proisise, 2nd Edition, Microsoft Press Publications, 1999. • Component-Based Software Engineering: Putting the Pieces Together by George T. Heineman and William T. Councill, 1st Edition, Addison-Wesley Professional Publications, 2001. • CORBA Programming by Jeremy L. Rosenberger, George T. HeinemanandWilliam T. Councill, 1st Edition, O'Reilly Publications, 1998.

Course Name: Mobile Application Development
Credit Hours: 3 (3+0)
Prerequisites: None
Objectives: This course is an extensive overview of the latest in mobile Applications. Studentswilllearn how to develop interactive mobile Applications for a variety of mobile devices including cellphones, PDAs and Pocket PCs. The course will be hands-on and project-based. Student will examine the development models for both the Apple iPhone and Google Android.
Course Outline: Mobile Application Development Overview, Mobile Devices Profiles, Mobile Software, Options for Development, Introduction to Software as a Service, Service-Oriented Computing Examples, Google Maps, Amazon Web Services, User Interface (UI), Development for Mobile Apps, User Interface Frameworks, Gesture-based Interfaces, The Eclipse Simulator, Google Application Architecture, Event-based Programming, Apple iPhone Platform, The UI Kit for Interfaces, Event Handling and Graphics Services, Layer Animation, Mobile Commerce, Symbian: Platform Architecture, Application Components, Development Methodology,Testing. Android: Platform Architecture, Application Components, Development Methodology, Testing.
Reference Material: • Mobile Design and Development: Practical Concepts and Techniques for Creating Mobile Sites and Web Apps by Fling and Brian, 1st Edition, O'Reilly Publications, 2009. • IPhone SDK by Jonathan Zdziarski, 1st Edition, O'Reilly Media Publication, 2009. • Hello-Android-Introducing-Development by Ed Burnett, 1st Edition, Pragmatic Bookshelf, 2008. • The Symbian OS Architecture Sourcebook: Design and Evolution of a Mobile Phone OS by Ben Morris, 1st Edition, Symbian Press, 2007.

Course name: Formal Methods for Software Engineering
Credit Hours: 3(3+0)
Prerequisites: None
Objectives: Formal specification is considered as an increasingly important activity within the software development process that has direct impact on the quality, maintenance, economic and success of a developed system. In this context, formal specification allows us to verify and reason about the properties of the software before proceeding with the design and implementation. The purpose of this course is to train students in the art and science for specifying properties of programs and proving their correctness. The primary emphasis will be on theoretical aspects of specification, formalisms, deductive and algorithms' verification.
Course Outline: Review of Mathematical Fundamental, Relations, Functions, Logical Expressions, First Order Logic, Quantifiers, Sequences, Undirected and Directed graphs, Requirement Analysis, Systems Specification, Model-based Approaches, Event-based Approaches, Algebraic Specification, Properties of Systems, Structural Properties, Behavioral Properties, Creation of Systems State, Change of State, Modeling of System Operation, State-based Verification of Systems, Invariant-based Verification of Systems, Structural and Dynamic Analysis of Systems.
Reference Material: • Formal Methods: State of the Art and New Direction by Paul Boca, Jonathan P. Bowen and Jawed Siddiqi, 1st Edition, Springer Publications, 2009. • Petri nets: An Introduction, by Wolfgang Reisig, 1st Edition, Springer-Verlag, 1985. • Using Z: Specification, Requirement and Proof by Jim Woodcock and Jim Davies, 1st Edition, Prentice-Hall, 1996.

Course Name: Web Application Development
Credit Hours: 3 (3+0)
Prerequisites: None
Objectives: After studying this course the students should be able to develop event driven windows applications and client server programs for networking environment. It will present a detailed and comprehensive look into JAVA and will provide the necessary tools to begin programming in the JAVA language. This course will help the students in developingreusableobjects for the real world Internet applications. Extensive programming work will be required for the course.
Course Outline: Introduction and Overview, Setting up the JAVA Environment, Constructors, Memory Management, Importing Packages, Classes, Sub classing and Language Syntax, Interfaces, Arguments, System Properties, JAVA Application Programmer Interface (API), JAVA Documentation (DOCS), Windows Programming, Forms and Abstract Window Toolkit (AWT), JAVA Swing Package, Event handling, Multi-threading Support, Input Output Streams, Collection Classes, Vector, Hash Table, Hash Map, Optimization Techniques, Vectors vs Arrays, Compiler Optimization and Performance, Advance Input Output, Serialized Issues, Writing Input Output Classes, Thread Concepts, Thread Synchronization, Monitors, Deadlock, Producer Consumer Problem, Java Beans, Version Control, JAVA database Connectivity (JDBC), Network Programming, Internet Addresses, Transmission Control Protocol(TCP) and User Datagram Protocol(UDP)Sockets, Writing client and Server applications, JAVA Security, JAVA Archives(JAR) utility, Creating JAR Files,JAVAApplets,Appletsvs Applications.
Reference Material: • Secure Java: For Web Application Development by AbhayBhargav and B. V. Kumar, CRC Press, 2010. • Java 2: Complete Reference by Herbert Schildt, 5th Edition, Osborne Press Publications, 2002. • Java Network Programming by Elliote Rusty Harlod, 2nd Edition, O'Reilly Publications, 2001. • Beginning Java 2 by Ivor Horton, 1st Edition, Peer Information, 1999.

Course Name: Data and Network Security

Credit Hours: 3 (3+0)

Prerequisites: None

Objectives: The Objective of the course is to understand the basic concepts of interfacing, synchronization issues, digital communication methods, data transmission and signal encoding techniques.

Course Outline: Introduction and overview, Data and Network Security, Networks, Protocols and Standards, Standard Organizations, Basic Concepts of OSI Model, Line Configuration, Topologies, Transmission Modes, Analog and Digital Signals, Simple and Complex Analog Signals, Time and Frequency Domain, Frequency Spectrum and Bandwidth, Digital Signals, Attenuation and Distortion Source, Limited Bandwidth, Delay, Noise, Encoding, Digital to Digital Conversion, Uni-polar, Bipolar, Analog to Digital Conversion, Pulse Amplitude Modulation, Pulse Code Modulation, Digital to Analog, Amplitude Shift Keying, Frequency Shift keying, Phase Shift Keying, Quardrature Amplitude Modulation, Analog to Analog Encoding, Amplitude Modulation, Frequency Modulation, Phase Modulation, Parallel Transmission, Serial Transmission, Asynchronous Transmission, Bit synchronization, Character Synchronization, Frame Synchronization, Synch Transmission,Interface, DTE-DCE Interfaces, Modems, Modem Operations and Transmission, Modem Standards, Transmission Media, Guided Media, Twisted Pair, Optical Fiber, Coaxial, Unguided Media, Radio Frequency Spectrum, Terrestrial Microwave, Satellite Communication, Cellular Telephony, Multiplexing, Frequency Division Multiplexing, Flow Control, Stop and wait, Sliding Window, Error Control, Automatic Repeat Request, Sliding window, Data Link Protocols.

Reference Material:

- Data and Network Securitys and Networking by Behrouz A. Forouzan, 3rd Edition, McGraw-Hill Publications, 2007.
- Data and Computer Communications by William Stallings, 8th Edition, MacMillan Publications, 2006.

Course Name: Game Development
Credit Hours:3 (3+0)
Prerequisites: None
Objectives: After studying this course the students should be able tomodel and develop games using latest game development technologies. It will help them model games related to science, technology, engineering, and mathematics.The course culminates with the completion of your very own interactive game on your chosen platform.
Course Outline: Introduction and Overview, Design Fundamentals, Math Review, Sketching basics, 2D Game Basics and User Interactions, Audio and More 2D Games, Deploying Games on Xbox 360 and Windows Plateform, 3D Computer Graphics Basics, 2D and 3D Content Generation, Modeling Human and Animal Charecters, Modeling Aliens, Modeling Vehicles, UV Mapping, Color Maps for 3D Models,Effects and HLSL Shaders, Content Pipeline, Sjeletal Animation and Third Person Shooter Game, Physics and Artificial Intelligence, Games for Education,Student Game Demonstrations and Presentations.
Reference Material: • Game Programming: From Novice to Professional by Lobao and Evangelista, 1st Edition,Apress Publications, 2009. • Game Development using Low Polygon Techniques by ChadWalkerand Eric Walker, 1st Edition, Charles River Media Publications, 2001. • Pro C# 2008 and the .NET 3.5 Platform by Troelsen, 4th Edition, Apress Berkeley Publications, 2007.

Course Name: Software Engineering-II

Credit Hours: 3 (3+0)

Prerequisites: None

Objectives: After studying this course the students should be able to propose, refine and criticize engineering process models and standards This course also covers techniques for specification, design process, object-oriented design, quality metrics, configuration management, software reuse, verification and validation techniques, documentation techniques and their standards.

Course Outline: Requirement Engineering, Functional and Non-Functional Requirements, Documents and Procedures for Gathering Requirements, Use Case Model, Functional Specifications, IEEE 830 recommended practice for software requirements specifications,IEEE 1074 Processes, Software Architecture, Components of Software Architecture, Architecture Diagrams, Deployment Diagrams, Software Design, Design Patterns, Creational Patterns: Factory, Abstract factory, Singleton, Builder, Prototype, Structural Patterns: Adaptor, Façade, Bridge, Composite, Proxy, Decorator, Flyweight, Behavioral Patterns: Iterators, Observer, Strategy, Command, Memento, Mediator,Anti-Patterns, Refactoring Techniques, Software Verification and Validation Techniques, Software Correctness, Formal Methods, Efficiency, Performance and Reliability, Attitude of Industry towards Reliability and Performance, Software Quality, Software Metrics, Function Point Analysis(FPA), Cost Constructive Model(COCOMO), Use Case base Estimation, Quality Assurance and Quality Control,Capability Maturity Model(CMM), Capability Maturity Model Integration(CMMI), ISO Software Quality Standards, Project Management Concepts, Software Project Planning, Risk Analysis, Project Scheduling and Tracking, Project Evaluation and Review Techniques(PERT), Critical Path Method (CPM), Software Quality Assurance, Inspections and Walkthrough.

Reference Material:

- Software Engineering: A Practitioner's Approach by Roger S. Pressman, 7th Edition, McGraw-Hill Publications, 2009.
- Object-oriented And Classical Software Engineering by Schach and Stephen, 7th Edition, Irwin Publications, 2006.
- Refactoring: Improving the Design of Existing Code by Fowler, 1stEdition,Addison-Wesley, 1999.
- Object-Oriented Modeling and Design with UML by James Rambaugh, 2nd Edition, Prentice Hall Publications, 2004.
- Design Patterns: Elements of Reusable Object-Oriented Software by Erich Gamma, Richard Helm, Ralph Johnson and John Vlissides, 1st Edition, Prentice Hall Publications, 1994.

Course Name: Digital Image Processing

Course Code:

Credit Hours: 3(3+0)

Prerequisites: N/A

Objectives: After successfully completing the course the students are expected to;

Cover the basic theory and algorithms that are widely used in digital image processing

Develop hands-on experience in using computers to process images

Familiarize with MATLAB Image Processing Toolbox

Be prepared for research in image processing if you choose to go that way.

Course Outline: Introduction of the Course, Presentation of Course Outline. Review of Matrices, Vectors, Probability and Linear Systems. Digital Image Fundamentals, Its Usability. Steps in performing Digital Image Processing and Components of Image Processing System. Elements of Visual Perception, Light and the Electromagnetic Spectrum, Image Sensing and Acquisition. Image Sampling and Quantization, Some Basic Relationships between Pixels. An Introduction to the Mathematical Tools Used in Digital Image Processing. Some Basic Intensity Transformation, Histogram Processing. Fundamentals of Spatial Filtering, Smoothing and Sharpening Spatial Filters. Using Fuzzy Techniques for Intensity Transformations and Spatial Filtering. Filtering in the Frequency Domain, Preliminary Concepts. Sampling and the Fourier Transform of Sampled Functions. The Discrete Fourier Transform (DFT) of One Variable, Extension to Functions of Two Variables. The Basics of Filtering in the Frequency Domain. Image Smoothing and sharpening Using Frequency Domain Filters. Restoration in the Presence of Noise Only—Spatial Filtering. Periodic Noise Reduction by Frequency Domain Filtering. Morphological Image Processing. Image Segmentation. Color Image Processing. Wavelets. Object Recognition.

Reference Material:

- Digital Image Processing Third Edition by Gonzalez and Woods
- Digital Image Processing using Matlab Third Edition by Gonzalez and Woods

Course Name: Distributed Database Systems
Credit Hours: 3 (3+0)
Prerequisites: None
Objectives: After Completing this course the students will be able to describe the difference of Centralized database and Distributed database. This course will help the students to design and implement distributed database for robust applications.
Course Outline: Introduction and Overview, Relational Model, Distributed Database Management System (DBMS)Architecture, Distributed Database Design and Data Distribution Strategies, Fragmentation, Distributed Transaction Management, Atomic consistent Isolated Durable(ACID) properties, Distributed Concurrency Control, Two Phase Commit Protocol (2PL), Distributed Database Recovery, Distributed Query Processing, Distributed Data Security, Replication, Update Protocols, Naming Transparency, Migration Transparency, Failure Transparency, Performance Issues.
Reference Material: • Distributed Database Management Systems: A Practical Approach by Saeed K. Rahimi and Frank S. Haug, 1st Edition, Wiley-IEEE Computer Society Publisher, 2010. • Principles of Distributed Database Systems by Ozsu Tamer, 1st Edition, Prentice Hall Publications, 1999. • Distributed Databases: Principles and System by Ceri and Pelagatti, 1st Edition, McGraw-Hill Publications, 1984.

Course Name: Programming Gaming Engines
Credit Hours: 3 (3+0)
Prerequisites: None
Objectives: This course provides students with an in-depth exploration of 3D game engine architecture. Students will learn state-of-the-art software architecture principles in the context of game engine design, investigate the subsystems typically found in a real production game engine, survey some engine architectures from actual shipping games, and explore how the differences between game genres can affect engine design. Students will participate in individual hands-on lab exercises, and also work together like a real game development team to design and build their own functional game engine by designing and implementing engine subsystems and integrating 3rd party components.
Course Outline: Introduction to Game Engine, Engine differences between game genres, Survey of runtime engine subsystems, Survey of tools and the asset pipeline, Version control and Subversion: Microsoft Visual Studio tips and tricks, Profiling tools, Memory leak, Corruption detection. 3D Math for Games: Vectors, Matrices, Quaternion, Spheres, Lines, Line segments and rays, Planes, Splines. The Graphics Pipeline: Triangle meshes, Materials, Texturing, Transformation, Lighting basics, Pipelining concepts, The rendering pipeline. Rendering Engine Architecture: the driver of rendering engine architecture, Primitive submission and render state management, Sorting, alpha blending and Z pre-pass, Visibility determination and scene graphs. Visual effects: Particles, overlays, decals, post pro-Graphical tools for debugging and development. Engine Subsystem Integration: The game loop, Time in games, Updating a multi-object simulation in real time, Integrating rendering, Physics and animation into the game loop, Multiprocessor game loops.
Reference Material: • Game Engine Architecture by Jason GregoryandJeff Lander, 1st Edition, A K Peters Publishers, 2009. • 3D Game Engine Design: A Practical Approach to Real-Time Computer Graphics by David H. Eberly, 2ndEdition, Morgan Kaufmann Publishers, 2006.

Course Name: Web Engineering

Credit Hours: 3 (3+0)

Prerequisites: None

Objectives: Thiscourseinvolves students in designing and writing web based software that can communicate across a computer network. The aim is to write our own objects for the real world Internet Applications using Javaanddistributedobjecttechnologiesthat can be accessed via network transparently. Extensive programming work will be required for the course.

Course Outline: Basic Network Concepts, Transmission Control Protocol/Internet Protocol (TCP/IP), User Datagram Protocol (UDP), Client Server Model, Web Concepts, Uniform Resource Link (URL), Hyper Text Markup Language (HTML), Hypertext Transfer Protocol (HTTP), Multi-Purpose Internet Mail Extensions (MIMIE), Applets and Security, Processing Internet Addresses (DNS, InetAddress Class), Sockets for Clients, Socket Class, Socket Exceptions, Sockets for Servers, Remote Method Invocation,RMIClient and Server, Java Servlets, Servlets Architecture, Objects, Request and Response, Sessions, Database Connectivity, Jdbc-Odbc bridge, Connection, Statement, Prepared Statement, Java Server Pages, Architecture, Container, Java Beans, Objects, Session Tracking, Cookies, Security, Input Output (IO), Login Management, JavaScript, Instruction Set, Events, Objects, Java Mail, Simple Mail Transfer Protocol (SMTP), Post Office Protocol (POP3), Mail Server, Java Mail API, XML, Rules, Document Type Definition (DTD), Internal and External DTD, Entities, XML parsing, SAX, DOM, Enterprise Java Beans, J2EE Architecture, State full and Stateless Session Beans, Entity Bean, Transaction Management, CORBA Architecture, IDL, Common Object Request Broker Object (CORBA)Client and Server, WAP Technologies, Simple Object Access Protocol (SOAP), Web Services Architecture and Design.

Reference Material:

- Web Engineering: A Practioner's Approach by Roger S. Pressman and David Lowe, McGraw-Hill Publications, 2008.
- Beginning JavaServer Pages by Vivek Chopra, Jon Eaves, Rupert Jones, Sing Li and John T. Bell, 1st Edition, Wrox Publications, 2005.
- Java Network Programming By Elliote Rusty Harlod, 3rd Edition, O'Reilly Publications, 2004.
- Enterprise Java Beans by Paul Tremlet, 1st Edition, Wrox Publications, 2000.
- Java Servlet Programming by Hunter and Crawford, 2nd Edition, O'Reilly Publications, 2001.
- CORBA Programming by Jeremy L. Rosenberger, 1st Edition, O'Reilly Publications, 1998.

Course Name: Data Mining

Credit Hours: 3(3+0)

Prerequisites: Data Structure and Algorithms, Probability and Statistics

Objectives: Data mining or discovery of knowledge in large datasets has created a lot of interest in the business and research communities in recent years. This course will provide a comprehensive introduction to the data mining process; build theoretical and conceptual foundations of key data mining tasks such as item set mining and clustering; discuss analysis and implementation of algorithms; and introduce major sub-areas such as text and web mining. Emphasis will be placed on the design and application of efficient and scalable algorithms. The students will get hands on experience through the implementation of algorithms and use of software tools in assignments. In addition, student will learn to explore, visualize, and analyze large datasets; and select and evaluate data mining techniques for the discovery of relevant knowledge from datasets.

Course Outline: Overview of Data Mining, need and motivation, data mining process; data mining tasks and functionalities, interestingness measures, Data Understanding and Preprocessing, Data exploration and visualization, basic stats, data cleaning, data reduction, dimensionality reduction, discretization, concept hierarchies, Mining Frequent Patterns and Associations, market basket analysis, Apriority algorithm, FP-growth algorithm, mining complex patterns, sequential pattern mining, Cluster Analysis, similarity measures, partitioning methods: K-Means, K-Medoids, hierarchical methods, density-based methods, clustering evaluation, outlier/anomaly detection, Text and Web Mining, Document representations, language models, text preprocessing, dimensionality reduction, Classification, Decision tree induction, model evaluation and selection, accuracy, confusion matrix

Reference Material:

- Data Mining: Concepts and Techniques, J. Han, M. Kamber, and J. Pei, Third Edition, Morgan Kaufmann Publishers, 2012.
- Web Data Mining, B. Liu, Springer, 2006.
- Introduction to Information Retrieval, C. Manning et al., Cambridge University Press, Available Online, 2008.

Course Name: Principles of Programming Languages
Credit Hours: 3 (3+0)
Prerequisites: None
Objectives: The purpose of this course is to provide a broad vision of Programming Language design and implementation. The student will develop knowledge on different aspects of the programming languages which will allow them to perform their critical evaluation and constructs.
Course Outline: Reason for studying Languages, Programming Domains, Language Evaluation Criteria, Language Evaluation Criteria, Language Design, Language Trade Offs, Language Syntax, Attributed Grammar, Dynamics Semantics, Naming Conventions, Variables, Binding Concept, Type Checking, Scope, Scope and Life Time, Reference Environment, Named Constant, Variable Initialization, Primitive Data Types, Character String Type, User Defined Ordinal Types, Array Types, Associative Array, Record Type, Union Type, Set Type, Pointer, Arithmetic Expressions, Operator Overloading, Type Conversion, Compound Statements, Selection Statements, Iterative Statements, Unconditional Branching, Subprogram, Design Issues of Subprogram, Parameter Passing Methods, Parameters that are Subprogram Names, Overloaded Subprograms, Generic Subprogram, Separate and Independent Compilation, Design Issues of Functions, Abstractions, Data Types, Encapsulation, Exceptional Handling.
Reference Material: • Concept of Programming Languages by Sebesta and Robert, 9th Edition, Addison-Wesley Publications, 2009. • Programming Languages: Principles and Paradigms by Allen B. Tucker,2nd Edition, McGraw-Hill Publications, 2007. • Programming Languages: Design and Implementation by Terrence W. Pratt and Marvin V. Zelkowitz, 4thEdition, Prentice Hall Publications, 2000. • Advanced Programming Language Design by Raphael Finkel, 1st Edition, Addison-Wesley Publications, 1995.

Course Name: Computer Graphics
Credit Hours: 3 (3+0)
Prerequisites: None
Objectives: To learn the tools and techniques used to draw and render complex images on a computer using basic objects as building blocks. Transformation of objects in 2D and 3D. To understand the basic mathematics involved. Understand the geometry of an image and be able to process image using some computational mechanism.
Course Outline: Graphics Hardware, Display Processors, Graphics Pipeline, Primitives, Point, Line, Polygon, Segment-Intersection Algorithm, Polygon-Point, Inside Outside Algorithm, Parity Testing Approach, Checking for Side with All Line segments, Vectors, Operations (Addition, Scalar Multiplication, Subtraction), Dot and Cross Product (Visualization and Properties), 2D Transformations, Rotation, Scaling, Reflection, Translation, Scan Converting Lines, Simple Scheme and its Problems, Incremental Variation, Midpoint Algorithm for Lines, Incremental Midpoint Algorithm, Scan Converting Circles, Eight Way Symmetry, Expensive Implicit and Polar Algorithm, Midpoint Algorithm, Using Incremental Technique to get rid of Multiplications, Scan Converting Ellipses, Additional Issues, Special Cases in which Order is Not Important, 2D Rotation about an Arbitrary Point, 3D Transformations, Scaling, Translation, Rotations Around Principle Axes in Right-Handed Coordinate System, About z-axis, About x-axis, About y-axis, Rotation about Arbitrary Axis, Aligned with Principle Axes (3 steps), Not-Aligned with Principle Axes (5 steps), Rotation through use of orthonormal property, Transforming Normal Vectors, Coordinate Transformation, Quadratic Bezier Curves, Subdivision, Derivation, Control Points, Using Colors on Computer Screen, Image Representation, Fourier Transformation, Image Manipulation, Filtering, Image Processing, Geometric Transformation of Images, Multipass Transformation, Image Composition.
Reference Material: • Fundamentals of Computer Graphics by Peter Shirley, 3rd Edition, AK Peters Publications, 2009. • Computer Graphics: Principles and Practice by Foley, Van Dam, Feiner and Hughes, 2nd Edition, Addison-Wesley Publications, 1990.

Course Name: Artificial Neural Networks
Credit Hours:3 (3+0)
Prerequisites: None
Objectives: It will be focused to introduce students the theory and practice of artificial neural networks and to train them to design and implement complex neural network systems for different problems of practical nature.
Course Outline: Introduction to Artificial Neural Networks, Human Brain, Artificial Neuron, History of Artificial Neural Networks, AI and Neural networks, Learning, Supervised and Unsupervised Learning, Error Correction Learning, Memory Based Learning, Hebbian Learning, Competitive Learning, Single Layer Perceptron, Classfication, Perceptron, Perceptron Convergence Theorem, Linear Separability, Credit Assignment Problem, Multilayer Perceptrons, Introdution of MLP and its Chracterisitcs, Back Propagation Algorithm, Heuristics for improving Back Propagation, Principal Components Analysis, Importance of PCA, Difference between Data and Feature Vectors, Algoirthm for PCA, VectorQuantization, Adaptive Resonance Theory, Basic Architecture, Stability-Plasticity Dilemma, ART Algorithm, Associative Memories, Linear Associative Memory.
Reference Material: • Neural Networks and Learning Machines by Simon Haykin, 3rd Edition, Prentice Hall, 2008. • Neural Networks: A Comprehensive Foundation by Simon Haykins, 2ndEdition, PrenticeHallPublications, 1999. • Fundamentals of Neural Networks by Laurence Fausett, 1st Edition, Prentice Hall Publications, 1993.

Course Name: System Programming

Credit Hours: 3 (3+0)

Prerequisites: None

Objectives: To enable students to program various I/O devices and write device drivers for those devices. To understand the internals of Operating Systems in terms of data structures used for Memory Management and File Management and to be able to access and exploit these data structures for developing system software.

Course Outline: Introduction to System Programming, I/O Modes, Programmed I/O, Handshaking/Polling, Interrupt Driven I/O, Interrupts, Hardware and Software Interrupts, Invoking Interrupts, Invoking interrupts from Windows Application, Intercepting Interrupts and TSR Programs, Intercepting Hardware Interrupts, Writing Interrupt Services for Certain Hardware, DMA (Direct Memory Access),Use of DMA, DMA interfacing, DMA internals, Programming the DMA, Programmable Devices, Interval Timer, Interval Timer Modes, Programming the Interval Timer, Programmable Peripheral Interface (PPI), Principles of Parallel Communication, PPI Internals and Modes, Programming the PPI, Using the PPI for Printer Interface, Using the PPI for Computer to Computer Communication, Universal Asynchronous Receiver Transmitter (UART), Principles of Serial Communication, UART Internals, Programming the UART, Using UART for Computer to Computer Communication, Operating System Internals, Memory Management, Real Mode, Memory Control Block (MCB), Arena Header, Memory Allocation, Traversing through Processes Memory, Protected Mode, Interrupts Descriptor Tables, Address Translation, Shifting from Real to Protected Mode, Exception Handling in Protected Mode, File Management, Disk Structure, Disk Formatting Process on Sectors and Clusters, File Allocation Table (FAT), FAT16 and FAT32, Drive Parameter Block, Disassembling the Directory and File structure, Accessing and Manipulating the File Structure, Sector/Partition Table Viruses, Anatomy of Executable File Viruses, Detection of Viruses, Sign of Viruses, Selecting the Signature of Viruses, Removal of Viruses, Prevention from Viruses.

Reference Material:

- System Programming with C and Unix by Adam Hoover, 1st Edition, Addison Wesley, 2009.
- PCIntern: The Encyclopaedia of System Programming by MichealTischer, 6th Edition, Abacus Software, 1996.
- C Odyssey: Advanced DOS by Vijay Mukhi, 2ndEdition,BPB Publications, 1992.
- Undocumented DOS by Andrew Schulman, 2nd Edition, Addison-Wesley Publications, 1993.

Course Name: Web Systems and Technologies
Course Code:
Credit Hours:3(3+0)
Prerequisites: Database Systems
Objectives: This course will extend the WWW Technologies and Web Based Applications architecture, development, deployment and management concepts studied in the course of Fundamentals of Information Technology. The instructor is expected to cover an in-depth treatment of the web technology and applications related topics including web standards, protocols, web applications architecture, web services, search engine architectures, content management, web2, and semantic web, to explore some of the technologies used for display, data access and processing, and to give the students practice in integrating these to produce a functional web-based system.
Course Outline: Introduction to Web Applications, Overview of WWW, Web Pages, Web Sites, Services and Web Servers. Introduction to HTTP, HTML and HTML5 Tags. Introduction to Dynamic Web Content, Introduction to CSS and CSS3. Client Side Programming: JavaScript: Basics, Expressions and Control Flow, Functions, Objects, and Arrays, Accessing CSS from JavaScript and Form Handling. Ajax. Server Side Programing: Programing in PHP. Introduction to MySQL and MySQL Functions. Cookies, Sessions, and Authentication. Introduction to Ajax, JQuery and Browsers. Designing a website.
Reference Material: 1. Web Application Architecture: Principles, protocols and practices by Leon Shklar and Richard Rosen, Wiley; 2nd Edition (May 5, 2009). ISBN-10: 047051860X 2. Web Technologies: A Computer Science Perspective by Jeffrey C. Jackson, Prentice Hall; 1st Edition (August 27, 2006). ISBN-10: 0131856030 3. Web Technologies by Uttam Kumar Roy, Oxford University Press, USA (June 13, 2011). ISBN-10: 0198066228

Course Name: Technical Game Design
Credit Hours: 3 (3+0)
Prerequisites: None
Objectives: This course focuses on the technical aspect of game development. Students will learn state-of-the-art architecture principles in context of game design and development, including the integration of essential Artificial Intelligence (AI) and animation techniques and various other mechanics of game development.
Course Outline: Progressive Meshes, Scene Hierarchies, Key frame Animation, Indexed and Non-Indexed Vertex Blending, Software and Hardware Skinning Techniques, Skeletal Animation, Tree Animation and Rendering, X Files, Motion Blending, Collision Detection and Response, Quadtrees, Octrees, and kD-Trees, Binary Space Partitioning (BSP) Trees and Potential Visibility Sets (PVS). Artificial Intelligence for Game Developers: Decision Making, Grid Traversal and Search Algorithms,Pathfinding with A*, Flocking Behaviors, Finite State Machines, Artificial Intelligence (AI) Engine Integration.Physics for Game Developers: The Principles of Newtonian Physics, Simulating Gravity, Simulating Friction, Modeling Acceleration and Velocity, Trajectories, Kinematics and Motion Control, Collision Detection and Response, Animation Technique, Procedural animation, Compression techniques, Animation system architecture and pipeline, Interfaces between game characters and animation, Animation state machines and layering,Collision detection basics, Fast-moving bodies and the bullet-through-paper problem, The Gilbert-Johnson-Keerthi (GJK) algorithm, The prune and sweep algorithm, Ray and sphere casting, Angulardynamics, Collision response, Constraints and ragdolls.
Reference Material: • Microsoft XNA Game Studio Creator's Guide by Stephen Cawood and Pat McGee, 1st Edition, McGraw-Hill Osborne Media, 2007. • Simulation and Event Modeling for Game Developers by John P Flynt and Benjamin Vinson, 1st Edition, Course Technology Publications, 2005. • 3D Game Programming: All in One by Kenneth C. Finney, 2nd Edition, Course Technology Publications, 2006.

Course Name: Multimedia Arts
Credit Hours: 3 (3+0)
Prerequisites: None
Objectives: This course is designed to describe the media and supporting devices commonly associated with multimedia information and systems. It will explain basic multimedia presentation concepts and demonstrate the use of content-based information analysis in a multimedia information system. It will critically analyze multimedia presentations in terms of their appropriate use of audio, video, graphics, color and other information presentation concepts. Students will learn the implementation of a multimedia application using a commercial authoring system.
Course Outline: Introduction and Overview, Multimedia basics, Working with Graphics, Text in Multimedia Design, Applications, Animations, Media Editors, Authoring Systems, Streams Structures, Capture, Represent, Transform, Spaces, Domains, Compression and Coding, Content-based Analysis, Indexing and Retrieval of Audio, Images and Video, Presentation, Rendering, Synchronization, Multi-modal Integration Interfaces, Real-time Delivery, Quality of Service, AudioVideo Conferencing, Video-On-Demand, Publishing Flash Document.
Reference Material: • Engineering Design of Multimedia Software by David Bernstein, 1st Edition,John Wiley and Sons, 2010. • Multimedia Design and Production for Students and Teachers by Counts, 1st Edition, Allyn and Bacon, 2003. • Multimedia Projects in the Classroom: A Guide to Development and Evaluation by Green and Brown, 1st Edition, Corwin, 2002. • Macromedia Flash MX 2004 for Windows and Macintosh: Visual Quick Start Guide by Ulrich, 1st Edition, Peachpit Press, 2003. • PowerPoint 2003 Bible by Wempen, 1st Edition, John Wiley and Sons, 2003.

Course Name: Game Algorithms
Credit Hours: 3 (3+0)
Prerequisites: None
Objectives: After studying this course the students should be able to solve algorithmic problems present in computer games. They will learn common solution methods, analyze their usability, and describe possible improvements. It will further help them to understand the concepts of random numbers, game trees, path finding, terrain generation, and decision-making for synthetic players.
Course Outline: Introduction and Overview, Model-View-Controller, Synthetic players Games and story-telling. Game design considerations, Random numbers. Linear congruential method. Analysis and testing, Shuffling. Game world creation, Terrain generation, Rank adjustment tournaments. Elimination tournaments, Scoring tournaments, Round robin, Game trees, Minimax, Partial Minimax, Game trees, Minimax, Partial Minimax, Path finding. Grid. Navigation mesh. Graph algorithms, Decision-making Finite State Machines (FSM), locking algorithms, Evaluation function. Algorithm A*. Movement realization, Influence maps, Modeling uncertainty, Recapitulation.
Reference Material: • Data Structures and Algorithms for Game Developers, by Allen Sherrod, 1st Edition, Delmar Learning Publications, 2010. • Core Techniques and Algorithms in Game Programming by Daniel Dalmau,1st Edition, New Riders Games Publications, 2003.

Course Name: Interactive Multimedia
Credit Hours: 3 (3+0)
Prerequisites: None
Objectives: This course is aimed at exposing students to the current and future trends in multimedia design and development. There is a huge amount of activity going on in this field with a big market all over the world, and new tools and technologies emerge quickly. Students shall learn them and familiarize themselves with the solution development using these tools.
Course Outline: Introduction to Multimedia Programming, Scope of Multimedia Programming, convention and trends, Media types used in current applications (including digital video, audio, and graphics). System level issues of performance synchronization, storage and server schemes, dynamic interactivity, hyper linking, multimedia device control, distributed media development and delivery, non-standard media and programming frame works. Creating Interactive Files, Scripts for adding Interactivity, Working with Sound and video, Font Software and Playback System, Introduction to Multi-media Networks, Interactive Multimedia on the Web.
Reference Material: • Digital Multimedia by Dr. Nigel Chapman and Jenny Chapman, 3rdEdition, Wiley Publications, 2009. • An Introduction to Digital Multimedia by T. M. Savage and K.E. Vogel, 1st Edition, Jones & Bartlett Publishers, 2008. • Digital and Development of Interactive Multimedia Systems by Dastbaz Mohammad, 1st Edition, McGraw Hill Publications, 2002.

Course Name: Computer Vision

Credit Hours: 3(3+0)

Prerequisites: None

Objectives: Computer Vision combines and integrates ideas from different areas, including statistics, linear algebra, pattern recognition, machine intelligence, decision theory and image processing.

Enable students to learn different techniques and algorithms of computer vision, implementation of different concepts of computer vision in Mat lab, C++, introduce a new area of study, in which students can pursue research and development.

Course Outline: Course introduction, along with an overview of the computer vision, digital images, imaging devices and the human eye, PPM and PGM formats, 2D Transformations (Translation, Scaling, Shear, Rotation, Affine, Projective), Mat lab Tutorial , Recovering best affine transformations, Image Warping, Image Registrations,3D transformations (optional), Camera Model, Perspective and Orthographic Cameras, Camera Calibration, Stereo , Gaussian Pyramids,

Sampling and Aliasing, Brightness constancy equation, normal vs. perpendicular flow,Lucas-Kanade method, Affine global motion estimation, Projective global motion, estimation, applications

Tentative: Motion Tracking , Thresholding, morphology, region properties, moments(optional),

connected component labeling, Low Pass Filter, Averaging Filter, Noise, Denoising, Difference masks, Laplacian of Gaussian (LoG), Canny, Hough Transform, Generalized Hough Transform, Correlation, Normalized Correlation, Distance Transform, Medial Axis Transform,HausdorffDistanceApplications:Background subtraction, Change Detection, skin detection

Reference Material:

- [Shah] Fundamentals of Computer Vision, Mubarak Shah, 1992
- [Shapiro] Computer Vision, Linda G. Shapiro, George C. Stockman,
- Prentice Hall, 2001
- [Snyder] Machine Vision, Wesley E. Snyder and Hairong Qi, Cambridge,
- 2004
- [Gonzalez, Woods] Digital Image Processing, 2nd Edition (Freely Available
- Online)

7.6 Supporting Electives

Course Name: Calculus II

Course Code:

Credit Hours: 3(3+0)

Prerequisites: Calculus l

Objectives:

- To prepare the students to understand comparatively the advanced concepts than the concepts they learnt in Calculus-I Course.
- To make the participants learn the techniques of handling multivariable functions i.e. calculating the limits and continuity of multivariable functions, partial differentiation, multiple integrals, etc. To enhance the vision of participants in developing mathematical models of engineering.

Course Outline:

MA 103 is a one-semester, three-credit hour's course at the intermediate level in multivariate calculus intended for students who have satisfactorily completed three-credits in Calculus and Analytical Geometry. The expansion from two to three (or more) dimensions requires a corresponding increase of the student's knowledge of symbolic representation. A new element, the vector, a symbol encompassing numbers, puts in its appearance. Students will learn how to work with vectors in modeling and solving problems in multidimensional space. Following this, the calculus of vectors and their description of curves and surfaces in space are considered. Differentiation of vectors is more fully developed, extending elementary notions of differentiation to those involving multiple variables. Integration is developed to encompass double integrals and triple integrals. Finally, line and surface integrals, Green's and Stoke's Theorem. Fourier Series: periodic functions, Functions of any period P-2L, Even & odd functions, Half Range expansions, Fourier Transform. Laplace Transform, Z-Transform is considered.

Reference Material:

1. Howard Anton, Calculus, 9th edition, John Wiley and Sons (WIE).

2. Erwin Kreyzing, Advanced Engineering Mathematics, 7th edition, 1993, John Wiley and Sons.

7.7 University Electives

Course Name: Introduction to Psychology
Credit Hours: 3 (3+0)
Prerequisites: None
Objectives: After studying this course the students should be able to apply different methods for understanding human behavior. It will help them identify a number of physiological and psychological factors that can affect a person's personality. They will be able to understand three stages of mind and the role of unconscious mind in personality building. It will enable them to apply some of the elementary techniques to manage conflict and frustration and mild form of behavioral disorders. It will further help them differentiate between primary and secondary motives and will also be able to manage and control their emotions.
Course Outline: Introduction and Overview, Historical Perspectives, Nature and Scope of Psychology, Branches of Psychology, Pure Psychology and Applied Psychology, Physiological Psychology, Comparative Psychology, Developmental Psychology, Educational Psychology, Industrial Psychology, Social Psychology, Abnormal Psychology, Clinical Psychology, Criminal and Legal Psychology, Methods of Psychology, Introspection, External Observation, Naturalistic Observation, Statistical Method, Case History Method, Genetic Method, Experimental Method, Research Methodology, Types of Learning, Learning by Insight or Intelligence, Learning by Trial and Error, Learning by Imitation, Learning by Conditioning, Importance of Reinforcement and Punishment, Perception, Monocular Cues, Binocular Cues, Illusion, Delusions, Hallucinations, Motivation, Classification of Motives, Hierarchy of Motives, Emotions, Basic or Primary Emotions, Theories of Emotions, Management of Emotions.
Reference Material: • Introduction to Psychology by Clifford T. Morgan and Richard A. King, 7th Edition, McGraw-Hill Publications, 2008. • EssentialsofUnderstandingPsychology by Robert S. Feldman, 8thEdition, McGraw-Hill Publications, 2008. • The Psychology of Learning and Motivation by Atkinson and Shiffrin, 2nd Edition, London, Academic Press Publications, 1980.

Course Name: International Relations
Credit Hours: 3 (3+0)
Prerequisites: None
Objectives: After studying this course the students will be able to appreciate the basic knowledge in the field of International Relations as a responsible citizen. The course also aims to enable the students to comprehend the current political controversies and conflicts among different nations and their impact on global peace and security. The students will also be able to realize the importance of skillful determination of foreign policy and effective diplomacy for the promotion of national and international interests.
Course Outline: Evolution and Scope of International Relations, Theories and Approaches related to International Relations, The Nation State System, National Interest, Diplomacy, Balance of Power, Cold War and its Impact, Non Aligned Movement, International Law, International Organizations, Colonialism, Neo-Colonialism and Imperialism, Foreign Policy, Fundamentals of Foreign Policy for an Islamic State, Foreign Policy of Pakistan, Relations of Pakistan with other Countries.
Reference Material: • Comparative Politics and International Relations by PrakashChander, 1st Edition, Cosmos BookhivePvt. Ltd. Publications, 2005. • Politics among Nations by Hans Morgenthau, 7th Edition, McGraw-Hill, 2005. • International Relations by Palmer Perkins, 3rd Edition, Houghton Mifflin Co., 2001.

Course Name: Foreign Language
Credit Hours: 3 (3+0)
Prerequisites: None
Objectives: After studying this course the students should be able to understand the meanings of Quran without any help of any translation.
Course Outline: Parts of Speech, The Noun, The Verb, The Harf, The Vowels, The Verbal Noun,The Gender of Noun, Real Gender, Formal Gender, Exceptional Cases, Common Gender, The Number of Nouns, Wahid or Mufrad, Tathniyah, The Plural of Nouns and Adjectives, The Sound Plural in Arabic, The Broken Plural, The Pronouns, Pronouns Attached to a Verb, Possessive Pronouns, Demonstrative Pronouns, The Relative Pronouns, Interrogative Pronouns, The Irab of Nouns, Declinable, Indeclinable, The Adjective Phrase, The Relative Phrase, The Demonstrative Phrase, The Genitive Phrase, Inseparable Prepositions, Separable Prepositions, The Sentence, The Nominal Sentence, The Verbal Sentence, Types of the Mubtada, The Omission of the Mubtada/ the Khabar, Types of the Khabar, The Verb, Perfect Tense, the Active and Passive of Madi, The Verbal Sentence, The Nominal Sentence, The Verbal Sentence, The Object, The Imperfect Tense, Six Groups of Triliteral Verbs, Moods of Verb, The Imperative Tense, The Derived Verbal Form-I till IX, The Unsound Verbs, The Sound Verbs, The Weak Verbs, The Mahmuz, The Muda'af, The Hamzated and Duplicated Radical, The Mahmuz, The Muda'af, The Numerals, The Nouns in Accusative.
Reference Material: • The Holy Quran. • Essentials of Arabic Grammar For Learning Quranic language by Brig.(R) Zahoor Ahmed,1st Edition, Darrusalam Publishers and Distributers, 2008. • Qamoos-ul-Quran: A Dictionary Compiled by QaziZain-ul-Abedin ,DarulIshaat Urdu Bazaar Karachi, 1994. • A Handbook of Arabic by Dr. Khalid Zaheer, 1stEdition, 2009.

Course Name: Organizational Behavior
Credit hours: 3 (3+0)
Prerequisites: None
Objectives: After studying this course the students should be able to apply different methods for understanding individual and organizational behaviors. This course will enable the students to identify and understand the factors that determine an individual's personality and can apply techniques for becoming a team player. They can select tactics for balancing the demands of professional and personal life. This course will help them apply different research methodologies for conducting research and surveys for effective job performance. It will also help them identify and apply prominent characteristics and attributes of leaders. They can easily pinpoint important factors that influence their personality in professional lives and how to communicate effectively at work.
Course Outline: Introduction to Organizational Behavior and Culture, What do Managers do? Management Functions, Management Roles, Contributing Disciplines to the OB field, Challenges and Opportunities for OB, Research Methodology, Purpose of Research, Research Design, Foundations of Individual Behavior, Biographical Characteristics, Learning Techniques, Types of Learning, Basic Approaches to Leadership, Prominent Qualities of a leader, Characteristic of Leader vs Manager, Theories of Leadership, Motivation, Importance of Motivation in our lives, Stages of Group Development, Group Structure, Personality Traits, What are Emotions, Felt vs Displayed Emotions.
Reference Material: • Behavior in Organizations by Gerald Greenberg and Robert A. Baron, 9th Edition Publisher, Prentice Hall Publications, 2007. • Organizational Behaviorby Stephen P. Robbins and SeemaSanghi, 13thEdition,Pearson Education India Publications, 2005. • Organizational Behavior by Fred Luthans, 11thEdition,McGraw-Hill Publications, 2006.

Course Name: Research Methodology
Credit Hours: 3 (3+0)
Prerequisites: None
Objectives: One of the major objectives of this course is to teachthestudentsdifferent research methodologies useful in their research work in the area of computer science. The course will help students understand what research methodology is and the various methods that researchers use to investigate problems. The course provides a framework for conceptualizing research and is meant to underpin the research project in the final semester as well as in their higher studies in the future. After studying the course students are expected to conduct research independently.
Course Outline: Introduction to computer scientist, Experimental computer science, Examine the theoretical areas of computer science, Issues involved in research, Need and purpose of research in computer science and engineering, Various research methods, Aspects of research evaluation, Available measurement and statistical techniques, Selection of research techniques, Identification and design of research problem being investigated, Implementation and visualization, General introduction to write research paper, Survey paper, Plagiarism, Making a good presentation, Short presentation, Long presentation, Critique of long presentations, Academic job hunting, Industry job hunting, Job hunting tips and interview skills.
Reference Material: • Research Methods by Donald H. McBurney and Theresa L. White, 8th Edition, Wadsworth Publishing, 2009. • Research Design and Methodology by Geoffery R. Marczyk, David DeMatteo and David Festinger, 1st Edition, John Wiley and Sons Publications , 2005. • Current research papers from top class journals in the field of Computer Science. • A little book of plagiarism by HEC.

Course Name: IT Entrepreneurship
Credit Hours: 3 (3+0)
Prerequisites: None
Objectives: After studying this course students will be able to discriminate between methodologies and use structured creative for problem solving and decision making to help enhance their chance of success in entrepreneurial activities, whilst critically evaluating strategic options and to contribute effectively to the discussion of entrepreneurial business case studies. The students will be able to develop a comprehensive business plan that includes sales, financial and legal considerations for starting and operating a small business.
Course Outline: Process of IT Entrepreneurship, Characteristic of an Entrepreneur, Developing a Successful Business Idea, Identifying and Recognizing Opportunities, Observing Trends, Solving a Problem, Encouraging and Protecting New Ideas, Feasibility Analysis, Industry and Competitor Analysis, Developing an Effective Business Model, Building a New Venture Team, Partnering for Success, Financial Strength and Viability, Ethical and Legal Issues Facing a New Firm, Choosing a Form of Business Organization, Plan, Presentation of Business Plan to the Investors, Getting Finance or Funding, Unique Marketing Issues, The importance of Intellectual Property, Preparing and Evaluating Challenges for Growth, Internal and External Growth Strategies.
Reference Material: • IT Entrepreneurship by Robert Hisrich, Michael Peters, and Dean Shepherd, 8th Edition, McGraw-Hill Publications, 2009. • IT Entrepreneurship by Bruce R. Barringer and R. Duane Ireland, 6th Edition, Pearson Publishers, 2006.

Course Name: Enterprise Resource Planning
Credit Hours: 3 (3+0)
Prerequisites: None
Objectives: The objective of this course is to make students aware of the potential and the limitations of enterprise systems through the means of case studies and lectures. It will enable the students to understand the challenges associated with the successful implementation of global Supply Chain ERP software with an emphasis on leadership and managerial implications.
Course Outline: Analyzing ERP systems through a managerial perspective, Planning and control systems used by manufacturing companies, How can ERP help a business organization, Obstacles to implementing ERP, ERP Modules and Historical Development, System Options and Selection Methods, Clarifying Business Strategy before Implementing an ERP, Business Process Redesign and Best Practices, ERP Implementation, ERP Project Management, Business Intelligence and ERP Systems, ERP and Supply Chains, ERP Security, Trends in ERP, Rationale for acquiring and implementing ERP systems, Selection of ERP software.
Reference Material: • Concepts in Enterprise Resource Planning by Ellen Monk and Bret Wagner, 3rd Edition, Course Technology Publication, 2008. • Enterprise Information Systems: Contemporary Trends and Issues by David L. Olson and SubodhKesharwani, 1st Edition World Scientific Publishing Company, 2009.

Course Name: Introduction to Business

Course Code: MG111

Credit Hours: 3(3+0)

Prerequisites: -

Objectives:

- This course is specifically designed to apply learning with an objective driven structure; by enhancing their divergent thinking patterns the students learn to apply there developed skills in different business environment for the best of solutions.
- By establishing a strong focal point in different areas of business ownership students learn to operate the major functional areas in a business enterprise: research & development, manufacturing, production & operations, marketing sales, distribution & customer support, finance and accounting, human resources and business services.
- A better understanding of how the economy operates is developed then factors that dominate the competition in a free market system is build which helps in understanding how economic measures and monitors help evaluate business performances in the welfare of the society.
- By educating the students of key factors in global business environment & international trade, different forms of international business activities are learned which helps in the expansion and stabilization of different business cycles.

Course Outline:

In every job, in every career, we use important business concepts. Whether you become professional managers, or Entrepreneurs, you will need good decision-making skills. Skills that will help students work with others in a professional manner, manage and organize their work, and manage other employees. This course introduces students to these concepts and shows how they can enhance good business decision-making. Through lively examples, the course emphasizes key skill areas including, decision-making and planning, teamwork, technology, and communication.In an environment of constant change understanding, comprehension and application of the dynamics of business functions is an imperative. It offers a thorough presentation of business principles and also highlights emerging business trends in the fields of Management, Human Resource, Production, Marketing, Finance and Supply chain.

Reference Material:

1. **"Business in Action"**, 5th Edition by Courtland L. Bovee. &Jhohn V. Thill Prentice Hall.
2. **Course Pack:**
    - Articles
    - Cases
    - Activity Models/Literature reviews

8.

- *The Future of Business*, 5th Edition, Lawrence J. Gitman, Carl McDaniel, Thompson

Course Name: Business Ethics

Course Code: SC330

Credit Hours: 3(3+0)

Prerequisites: -

Objectives:

The purpose of the course is to improve your abilities and develop illustrating mature, reasonable and professional thought. Develop better internal and external relationships and a spirit of social and professional cooperation this course will help in skills development, identification and analysis of moral issues. Business ethics focus on making good decisions rather than the 'right' decision. While dealing with the subject of business ethics it will be learnt that how to handle moral issues and conflicts while acquiring moral courage. Acquiring the critical attitude towards business and its disciplines.

Course Outline:

It is expected that both the stakeholders (teacher and students) adhere to decorum of professional and ethical conduct. Cheating, plagiarism (submitting the language, ideas, thought or work of others as one's own) or otherwise indulging in unfair means to obtain a grade under false pretenses will result in strong disciplinary action leading to removal from the course. Any deliverables found falling in such category will result in straight zero without further re-submission.

Participants will act in a professional manner while attending classes and will adhere to all policies, rules and regulations of UMT and SBE. Participants will be required to come in class on time, and strictly follow the assigned timings for breaks etc. Use of cell phones in the class is strictly prohibited.

Reference Material:

Business Ethics- concepts and cases, seventh edition by Manuel G. Velasquez

Course Name: Leadership Skills

Course Code: MG111

Credit Hours: 3(3+0)

Prerequisites: -

Objectives:

After completing this course, participants should be able to:

- To understand the difference between managers and leaders in our global economy today
- Know the changes in leadership theories and practices that have occurred over time and their affects.
- Understand the importance of ethical leadership practices
- Be able to assess why people do what they are doing
- To be able to work apply the knowledge and concepts learnt in the class to real life organization and to come up with relevant set of solutions and recommendations.
- To learn how managers can be motivated to become leaders

The course helps you develop and understand of what it takes to be an effective leader.

Course Outline:

Course covers introduction to leadership, how managers and leaders differ, how leaders create their own paths, give direction, enlighten followers and create an environment of progressive change. This course will be focusing on how managers can become leaders, with learning, practice and discipline. You will be focusing on learning one or two leadership skills.

Reference Material:

The Leadership Experience,

By Richard L. Daft – 4th Edition-South-Western Publication

Course Name: Logical Reasoning

Course Code:

Credit Hours: 3(3+0)

Prerequisites: -

Objectives:

Upon completion of the subject, students will be able to:

i. master the basic skills of logical reasoning and critical thinking
ii. evaluate whether an argument is sound or unsound (and explain why it is sound/unsound) with the help of logical analysis
iii. detect unclear or misleading uses of language and logical fallacies in arguments
iv. be aware of and avoid cognitive biases and traps of irrational persuasions
v. master the basic skills of judging the reliability of information

Course Outline:

The basic concepts and principles of logical and critical thinking will be explained and discussed in the lectures. Emphasis will be put on practical applications of these concepts and principles in everyday life, drawing updated examples from newspapers, magazines and everyday discourses and arguments. This course combines lectures, interpretive exercises in the assigned texts, practical exercises, classroom discussions, quick tests and mind-teasers.

Reference Material:

- Critical thinking: An introduction to reasoning by Francis Watanabe Dauer
- Logic: A Very Short Introduction (Paperback) by Graham Priest
- Reason and Argument by Peter T. Geach
- Formal Logic: Its Scope And Limits by Richard C. Jeffrey
- What Einstein Told His Barber: More Scientific Answers to Everyday Questions by RobertL.Wolke
- Language, Truth and Logic by A.J. Ayer
- A Good book for VA – How to Prepare for Verbal Ability and Reading Comprehension for the CAT Common Admission Test 4th Edition (Paperback) by MeenakshiUpadhyay, Arun Sharma. Publisher: Tata McGraw Hill, Rs. 575, 2011 Edition

Course Name: Management Information Systems

Course Code: IS240

Credit Hours: 3(3+0)

Prerequisites: -

Objectives:

This course is designed to introduce students to computer-based information systems and their role in business organizations. Topics to be covered include a discussion of the nature of information and its contribution to the strategic, managerial, and operational aspects of business, the role of information technology in business process reengineering. The planning, analysis, design, and implementation needed achieve successful information systems, and telecommunications - that underlie these systems. However, the emphasis of the course will be on the managerial used of computer information systems, not the technology by itself.

Course Outline:

The teaching of the course will be via a series of lectures. This will be complemented by the use of textbook and an extensive range of web resources plus handouts.

Participants will be required to work in study groups for the final project. Participants are required to prepare and share a range of study material derived from the assessment process. The aim of the study groups is to enhance the learning environment of the class.

Participants should expect 4-5 quizzes during the semester. Quizzes will be unannounced. There shall be no makeup quizzes for missed sessions and/or low scoring quizzes.

Submission deadlines for assignments, cases and the project will not be extended. Participants shall not waste their time and energies to plead for one.

Reference Material:

- Management Information System: by Kenneth C. Laudon& Jane P. Laudon
- Information System Today by Laudon

Course Name: Principles of Management

Course Code: MS323

Credit Hours: 3(3+0)

Prerequisites: -

Objectives:

To provide basic and relevant knowledge about management in organizations

To incorporate within the curriculum major emphasis on the development of students' fundamental learning skills, for example: reasoning and quantitative abilities; as well as communication and computing skills which they will need for responsible leadership roles in their careers

To train the students to develop an understanding and appreciation of the global business environment.

Course Outline:

Classify managerial and non-managerial employees. Define management. Describe the functions, roles and skills of managers and how the manager's job is changing. Describe the characteristics of an organization. Explain the value of studying management. Describe the historical background of management. Explain various theories in the classical approach. Describe the quantitative approach. Discuss the development and uses of the behavioral approach. Explain various theories in the contemporary approach. Describe the general and tasks environment and the dimensions of each.

Explain the strategies managers use to help organizations adapt to an uncertain environment.

Define corporate culture and give organizational examples.

Explain organizational symbols, stories, heroes, slogans and ceremonies and their relationships to corporate culture.

Describe how corporate culture relates to the environment.

Define the cultural leader and explain the tools a cultural leader uses to change corporate culture.

Reference Material:

- Management by Stephen P. Robbins & Mary Coulter, 9th Edition, Prentice Hall
- Understanding Management by Richard L. Daft & Dorothy Marcic, 7th edition. Thomson South Western.
- Management by Danny Samson & Richard L. Daft, Thomson Learning

Course Name: Principles of Marketing

Course Code: MK210

Credit Hours: 3(3+0)

Prerequisites:

Objectives:

1. To provide an understanding of what marketing is all about.
2. To describe marketing process, marketing planning, marketing research, consumer markets and buying behavior, market segmentation, product mix, product planning and development, branding, price determination and strategies, retailing, promotional program, advertising and sales promotion.
3. To explain the different concepts of marketing with examples from present day businesses.

Course Outline:

Principles of Marketing: Fundamentals of Marketing offers the student an overview of the information required to identify key marketing terms, language, and concepts. The program details the elements of the marketing mix, the stages of the product life cycle, and the proper steps to implement the market segmentation process specifically.

This course explains if you know the Basic principles/concepts of marketing you can use them in every aspect of one's business to gain the extra advantage.

Reference Material:

.Principles of Marketing 13th Edition (A South Asian Perspective) by Kotler, Armstrong, Agnihotri and Haque.

Helpful sites: http://auroramagazine.blogspot.com/

http://www.quickmba.com/

http://www.atkinson.yorku.ca/~lripley/imsyllabus.htm#x

Supplementary Material:

Lecture notes (updated on Moodle)

Course Name: Social Network and Society

Course Code: SS145

Credit Hours:3(3+0)

Prerequisites: N/A

Objectives:

The objectives of this course for students are as follows:

- Understand to the basic concepts of social network analysis (Evaluation: problem sets)
- Collaborative with peers to apply these methods to a variety of social media (Evaluation: projects)
- Understand the link between qualitative and quantitative methods of social network analysis (Evaluation: short analysis papers)
- Understand how these social technologies impact society and vice versa (Evaluation: in-class discussion)

Course Outline:

The proliferation of social media – social networking websites, blogging and microblogging, and other forms of online interaction and content generation – has introduced a powerful tool for people to communicate and share information. This course will introduce methods for analyzing and understanding how people use these technologies and their societal implications. The course will introduce students to the science and social science of network analysis. Through real world examples, including analysis of their own social networks, students will develop skills for describing and understanding the patterns and usage of services like Facebook, Twitter, YouTube, and others. Students will read classic and cutting edge articles and books about these topics and discuss their applicability to this new social media. The class will culminate with a capstone project in which students will apply the analysis methods they have learned to understanding a particular question about social networks and social media.

Reference Material:

Linked: How Everything Is Connected to Everything Else and What It Means , by Albert-Laszlo Barabasi.