University of Malakand
Department of Computer Science & Information Technology

UNDERGRADUATE CURRICULUM
BS (CS)

A Student majoring in Bachelor Studies in Computer Science BS (CS) must complete minimum of 132 Credit Hours courses. The courses list is as follows:

First Year	**FALL SEMESTER**	
Course #	Title	Cred.Hrs.
BCS111	Calculus and Analytical Geometry	3-0
BCS112	Physics	3-0
BCS113	Functional English	3-0
BCS114	Introduction to Information and Communication Technologies (ICTs)	4 (3-1)
BCS115	Islamiat	2-0
BCS116	Programming Fundamentals	4(3-1)
	Total Semester Cred Hrs	**19**
First Year	**SPRING SEMESTER**	
Course #	Title	Cred.Hrs.
BCS121	Digital Logic Design	3-0
BCS122	Technical and Report Writing	3-0
BCS123	Statistics & Probability	3-0
BCS124	Discrete Mathematical Structures	3-0
BCS125	Data Structures	3-0
BCS126	Basic Electronics	3-0
	Total Semester Cred Hrs	**18**
Second Year	**FALL SEMESTER**	
Course #	Title	Cred.Hrs.
BCS231	Communication & Presentation Skills	3-0
BCS232	Object Oriented Programming	4(3-1)
BCS233	Operating Systems	3-0
BCS234	Introduction to Databases	4(3-1)
BCS235	Pak Studies	2-0
BCS236	Multivariate Calculus	3-0
	Total Semester Cred Hrs	**19**
Second Year	**SPRING SEMESTER**	
Course #	Title	Cred.Hrs.
BCS241	Database Administration	3-0
BCS242	Linear Algebra & Applications	3-0
BCS243	Computer Organization and Assembly Language	4(3-1)
BCS244	Web Technologies	4(3-1)
BCS245	Software Engineering-I	3-0
	Total Semester Cred Hrs	**17**

Third Year	**FALL SEMESTER**	
Course #	Title	Cred.Hrs.
BCS351	Data Communication and Networks	3-0
BCS352	Artificial Intelligence	3-0
BCS353	System Programming	3-0
BCS354	Advanced Object Oriented Programming	4(3-1)
BCS355	Differential Equations	3-0
BCS356	Software Engineering-II	3-0
	Total Semester Cred Hrs	**19**
Third Year	**SPRING SEMESTER**	
Course #	Title	Cred.Hrs.
BCS361	Theory of Automata and formal languages	3-0
BCS362	Analysis of Algorithms	3-0
BCS363	Network Strategies	3-0
BCS364	E-Commerce	3-0
BCS365	Rich Internet Applications	4(3-1)
BCS366	Computer Graphics	3-0
	Total Semester Cred Hrs	**19**
Fourth Year	**FALL SEMESTER**	
Course #	Title	Cred Hrs
BCS471	Senior Design Project	0-6
BCS472	Numeric and symbolic Computation	3-0
BCS473	Information Security	3-0
BCS474	Computer Architecture	3-0
	Total Semester Cred Hrs	**15**
Fourth Year	**SPRING SEMESTER**	
Course #	Title	Cred Hrs
BCS481	Software Project Management	3-0
BCS482	Professional Practices	3-0
BCS483	Systems and Network Administration	4(3-1)
BCS484	Compiler Construction	3-0
	Total Semester Cred Hrs	**13**

Note:

Total Credit Hours: 139
The courses and semester plan can be modified subject to the decision of board of studies.

Computing — Requirements for Bachelor Degree Programs

Required Computing Courses		
#	**Knowledge Area**	**Credit hours**
1	Computing Core Areas	40
2	Supporting Sciences	12
3	General Education	16
Total		**68/130**

Computing — Core Courses (40 Credits Hours)

Required Computing Courses					
#	Code	Preq	Course Title	Credit Hours	Proposed Semester
1	CS	-	Introduction to Information and Communication Technologies(ICTs)	4 (3-1)	1
2	CS	-	Programming Fundamentals	4 (3-1)	1
3	CS	2	Object Oriented Programming	4 (3-1)	3
4	CS	-	Discrete Mathematical Structures	3 (3-0)	2
5	CS	2	Data Structures	3 (3-0)	2
6	CS	1	Digital Logic Design	3 (3-0)	2
7	CS	5	Operating Systems	3 (3-0)	3
8	CS	5	Introduction to Databases	4 (3-1)	3
9	CS	5	Software Engineering-I	3 (3-0)	4
10	CS	7	Data Communication and Networks	3 (3-0)	5
11	CS	-	Senior Design Project **(40/130)**	6 (0-18)	7

Computing — Supporting Sciences (12 Credits Hours)

Required Supporting Courses					
#	Code	Preq	Course Title	Credit hours	Proposed Semes
12	MT	-	Calculus and Analytical Geometry	3 (3-0)	1
13	MT	-	Statistics and Probability	3 (3-0)	2
14	MT	-	Linear Algebra and Applications	3 (3-0)	4
15	PH	-	Physics (Electromagnetism) **(12 /130)**	3 (3-0)	1

Computing — General Education (15 Credits Hours)

Required General Education Courses					
#	**Code**	**Preq**	**Course Title**	**Credit hours**	**Proposed Semester**
1	EG	-	Functional English	3 (3-0)	1
2	EG	-	Technical and Report Writing	3 (3-0)	2
3	EG	-	Communication and Presentation Skills Skills	3 (3-0)	3
4	PK	-	Islamic and Pakistan Studies	4 (4-0)	1,3
5	SS	-	Professional Practices **(16/130)**	3 (3-0)	8

Computing — Detail of Courses

Core Courses (40 Credits Hours)

Course Name: Introduction to Information and Communication Technologies (ICTs)	
Course Structure: Lectures: 3 / Labs: 3	**Credit Hours:** 4
Prerequisites: None	
Objectives: This course focuses on a breadth-first coverage of computer science discipline, introducing computing environments, general application software, basic computing hardware, operating systems, desktop publishing, Internet, software applications and tools and computer usage concepts; Introducing Software engineering and Information technology within the broader domain of computing, Social issues of computing.	
Course Outline: Number Systems, Binary numbers, Boolean logic, History computer system, basic machine organization, Von Neumann Architecture, Algorithm definition, design, and implementation, Programming paradigms and languages, Graphical programming, Overview of Software Engineering and Information Technology, Operating system, Compiler, Computer networks and Internet, Computer graphics, AI, Social and legal issues.	
Reference Material: *Computers: Information Technology in Perspective, 12/e:* Larry Long and Nancy Long *An Invitation to Computer Science, 5/e:* Schneider and Gersting, Brooks/Cole Thomson Learning, 2000. *Computer Science: An overview of Computer Science,* Sherer.	

Course Name: Programming Fundamentals	
Course Structure: Lectures: 3 / Labs: 3	**Credit Hours:** 4
Prerequisites: None	
Objectives: The course is designed to familiarize students with the basic structured programming skills. It emphasizes upon problem analysis, algorithm designing, and programme development and testing.	
Course Outline: Algorithms and problem solving, development of basic algorithms, analyzing problem, designing solution, testing designed solution, fundamental programming constructs, translation of algorithms to programmes, data types, control structures, functions, arrays, records, files, testing programmes.	
Reference Material: *Programme Design with Pseudo-code,* Bailey and Lundgaard, Brooks/Cole Publishing, 1988 *Simple Programme Design: A step-by-step approach,* 5/e, Lesley Anne Robertson, ISBN: 0-619-16046-2 © 2004.	

Course Name: Object Oriented Programming	
Course Structure: Lectures: 3 / Labs: 3	**Credit Hours:** 4
Prerequisites: Introduction to Computing, Programming Fundamentals	
Objectives: The course aims to focus on object-oriented concepts, analysis and software development.	
Course Outline: Evolution of OO, OO concepts and principles, problem solving in OO paradigm, OO programme design process, classes, methods, objects and encapsulation; constructors and destructors, operator and function overloading, virtual functions, derived classes, inheritance and polymorphism. I/O and file processing, exception handling	
Reference Material: *Understanding Object Oriented Programming,* Budd, Addison Wesley. *Java: How to Programme,* 5/e, Deitel and Deitel, Prentice Hall, 0131016210/ 0131202367 International Edition. *C++: How to Programme,* Deitel and Deitel, 4/e, Pearson. *Thinking in C++,* 2nd Edition, Bruce Eckel, Prentice Hall.	

Course Name: Data Structures	
Course Structure: Lectures: 3 / Labs: 0	**Credit Hours:** 3
Prerequisites: Object Oriented Programming	
Objectives: The course is designed to teach students structures and schemes, which allow them to write programs to efficiently manipulate, store, and retrieve data. Students are exposed to the concepts of time and space complexity of computer programs.	
Course Outline: Introduction to data structures; Arrays, Stacks, Queues, Priority Queues, Linked Lists, Trees, and Graphs. Recursion, sorting and searching algorithms, Hashing, Storage and retrieval properties and techniques for the various data structures. Algorithm Complexity, Polynomial and Intractable Algorithms, Classes of Efficient Algorithms, Divide and Conquer, Dynamic, Greedy	
Reference Material: *Data Abstraction and Problem Solving with C++, 2nd ed, Frank M. Carrano, Paul Helman, Robert Verof, Addison-Wesley, 1998.* *Data Structures and Algorithms* (SAMS teach yourself), Lafore, Sams Publishing, 1999. *Fundamentals of Data Structures in C++,* Horowitz, Sahni, and Mehta, Computer Science Press, 1995. *Data Structures in JA VA,* Standish, Addison Wesley, 2000	

Course Name: Discrete Mathematical Structures	
Course Structure: Lectures: 3 / Labs: 0	**Credit Hours:** 3
Prerequisites: None	
Objectives: Introduces the foundations of discrete mathematics as they apply to Computer Science, focusing on providing a solid theoretical foundation for further work. Further, this course aims to develop understanding and appreciation of the finite nature inherent in most Computer Science problems and structures through study of combinatorial reasoning, abstract algebra, iterative procedures, predicate calculus, tree and graph structures	
Course Outline: Introduction to logic and proofs: Direct proofs; proof by contradiction, Sets, Combinatorics, Sequences, Formal logic, Prepositional and predicate calculus, Methods of Proof, Mathematical Induction and Recursion, loop invaria, composition); relations (reflexivity, symmetry, transitivity, equivalence relations); sets (Venn diagrams, complements, Cartesian products, power sets); pigeonhole principle; cardinality and countability.	
Reference Material: *Discrete Mathematics and Its Applications,* 5th edition; by Rosen; McGraw-Hill; 0-0 7-242434-6.	

Course Name: Digital Logic Design	
Course Structure: Lectures: 2 / Labs: 3	**Credit Hours: 3**
Prerequisites: Introduction to ICTs	
Objectives: This course introduces the concept of digital logic, gates and the digital circuits. Further, it focuses on the design and analysis combinational and sequential circuits. It also serves to familiarize the student with the logic design of basic computer hardware components.	
Course Outline: Overview of Binary Numbers, Boolean Algebra, switching algebra, and logic gates, Karnaugh Map and Quin-McCluskey methods, simplification of Boolean functions, Combinational Design; two level NAND/NOR implementation, Tabular Minimization, Combinational Logic Design: adders, subtracters, code converters, parity checkers, multilevel NAND/NOR/XOR circuits, MSI Components, design and use of encoders, decoders, multiplexers, BCD adders, and comparators, Latches and flip-flops, Synchronous sequential circuit design and analysis, Registers, synchronous and asynchronous counters, and memories, Control Logic Design, Wired logic and characteristics of logic gate families, ROMs, PLDs, and PLAs, State Reduction and good State Variable Assignments, Algorithmic State	
Reference Material: *Digital Design, 2nd Ed.*, M. Morris Mano, Prentice Hall, 1991. Practical Digital Logic Design and Testing, P K Lala, Prentice Hall, 1996**.**	

Course Name: Introduction to Databases	
Course Structure: Lectures: 3 / Labs: 3	**Credit Hours: 4**
Prerequisites: Data Structures	
Objectives: The course aims to introduce basic database concepts, different data models, data storage and retrieval techniques and database design techniques. The course primarily focuses on relational data model and DBMS concepts.	
Course Outline: Basic database concepts; Entity Relationship modelling, Relational data model and algebra, Structured Query language; RDBMS; Database design, functional dependencies and normal forms; Transaction processing and optimization concepts; concurrency control and recovery techniques; Database recovery techniques; Database security and authorization. Small Group Project implementing a database. Physical database design: Storage and file structure; indexed files; hashed files; signature files; b-trees; files with dense index; files with variable length records; database efficiency and tuning Data Warehousing and Data Mining, Emerging Database Technologies and Applications.	
Reference Material: *Database Systems,* C.J.Date, Addison Wesley Pub. Co. (2004). *Database Systems: A Practical Approach to Design, Implementation and Management,* R.Connolly and P.Begg, Addison-Wesley Pub. Co (2003). Fundamentals of Database Systems, 3/E, Elmasri and Navathe, Addison-Wesley, ISBN: 0-201-74153-9.	

Course Name: Operating Systems	
Course Structure: Lectures: 3 / Labs: 0	**Credit Hours:** 3
Prerequisites: Data Structures	
Objectives: The objective of this course is to give students knowledge of construction and working of Operating systems, to enable them to understand management and sharing of computer resources, communication and concurrency and develop effective and efficient applications and also to appreciate the problems and issues regarding multi-user, multitasking, and distributed systems.	
Course Outline: History and Goals, Evolution of multi-user systems, Process and CPU management, Multithreading, Kernel and User Modes, Protection, Problems of cooperative processes, Synchronization, Deadlocks, Memory management and virtual memory, Relocation, External Fragmentation, Paging and Demand Paging, Secondary storage, Security and Protection, File systems, I/O systems, Introduction to distributed operating systems. Scheduling and dispatch, Introduction to concurrency.Lab assignments involving different single and multithreaded OS algorithms.	
Reference Material: *Applied Operating Systems Concepts,* 6th Edition, Silberschatz A., Peterson, J.L., & Galvin P.C. 1998. *Modern Operating Systems,* 2nd Edition, Tanenmaum A.S., 2001.	

Course Name: Data Communication and Networks	
Course Structure: Lectures: 3 / Labs: 0	**Credit Hours:** 3
Prerequisites: Operating Systems	
Objectives: To introduce students to the concept of computer communication. Analogue & digital transmission. Network Layers, Network models (OSI, TCP/IP) and Protocol Standards. Emphasis is given on the understanding of modern network concepts.	
Course Outline: Analogue and digital Transmission, Noise, Media, Encoding, Asynchronous and Synchronous transmission, Protocol design issues. Network system architectures (OSI, TCP/IP), Error Control, Flow Control, Data Link Protocols (HDLC, PPP). Local Area Networks and MAC Layer protocols (Ethernet, Token ring), Multiplexing, Switched and IP Networks, Inter-networking, Routing, Bridging, Transport layer protocols TCP/IP, UDP. Network security issues. Programming exercises or projects involving implementation of protocols at different layers.	
Reference Material: *Introduction to Computer Networks,* Tanenbaum *Unix Network Programming*, Richard Stevens *Computer networks: a systems approach,* Larry Peterson, Bruce Davie, Princeton Univ. Princeton. Computer Networking: A Top-Down Approach Featuring the Internet, 2/e, James F Kurose, Keith W Ross, Addison Wesley 2003. ISBN: 0-201-97699-4.	

Course Name: Software Engineering-I	
Course Structure: Lectures: 3 / Labs: 0	**Credit Hours: 3**
Prerequisites: Data Structures	
Objectives: To study various software development models and phases of software development life cycle. The concepts of project management, change control, process management, software development and testing are introduced through hands-on Team Projects.	
Course Outline: Introduction to Computer-based System Engineering; Project Management;Software Specification; Requirements Engineering, System Modelling; Requirements Specifications; Software Prototyping; Software Design: Architectural Design, Object-Oriented Design, UML modelling, Function-Oriented Design, User Interface Design; Quality Assurance; Processes & Configuration Management; Introduction to advanced issues: Reusability, Patterns; Assignments and projects on various stages and deliverables of SDLC.	
Reference Material: *Software Engineering: A Practioner's Approach,* Roger Pressman, McGraw-Hill, 2001. *Object-Oriented Software Engineering,* Stephan Schach, Irwin, 1999.	

Computing-Supporting Sciences (12 Credits Hours)

Course Name: Calculus and Analytic Geometry	
Course Structure: Lectures: 3 / Labs: 0	**Credit Hours:** 3
Prerequisites: None	
Objectives: To build the basic calculus and analytical geometry background.	
Course Outline: Complex Numbers, DeMoivre's Theorem and its Applications, Simple Cartesian Curves, Functions and Graphs, Symmetrical Properties, Curve Tracing, Limit and Continuity, Differentiation of Functions. Derivative as Slope of Tangent to a Curve and as Rate of Change, Application to Tangent and Normal, Linearization, Maxima/Minima and Point of Inflexion, Taylor and Maclaurin Expansions and their convergence. Integral as Anti-derivative, Indefinite Integration of Simple Functions. Methods of Integration: Integration by Substitution, by Parts, and by Partial Fractions, Definite Integral as Limit of a Sum, Application to Area, Arc Length, Volume and Surface of Revolution.	
Reference Material: Calculus and Analytical Geometry By Swokowski, Olinick and Pence. Calculus, *H. Anton, John Wiley and Sons (WIE), ISBN: 0471572608*. Calculus, William E. Boyce Richard C. Diprima, John Wiley & Sons.	

Course Name: Statistics and Probability	
Course Structure: Lectures: 3 / Labs: 0	**Credit Hours:** 3
Prerequisites: None	
Objectives: To introduce the concept of statistics, randomness and probability and build on these concepts to develop tools and techniques to work with random variables	
Course Outline: Introduction to Statistics, Descriptive Statistics, Statistics in decision making, Graphical representation of Data Stem-and Lead plot, Box-Cox plots, Histograms and Ogive, measures of central tendencies, dispersion for grouped and ungrouped Data, Moments of frequency distribution; examples with real life, use of Elementary statistical packages for explanatory Data analysis. Counting techniques, definition of probability with classical and relative frequency and subjective approaches, sample space, events, laws of probability. *General Probability Distributions,* Conditional probability and Bayes theorem with application to Random variable (Discrete and continuous) Binomial, Poisson, Geometric, Negative Binomial Distributions; Exponential Gamma and Normal distributions. *Regression and Correlation.*	
Reference Material: *Introduction to Statistics,* Walpole, 1982 Prentice Hall, ISBN: 0024241504. *Statistical Data Analysis,* G. Cowan G, 1998, Clarendon, Oxford. *Advances in Statistical Analysis and Statistical Computing III* Mariano R (Ed.), (1993), JAI Press, Greenwich, Conn.	

Course Name: Physics (Electromagnetism)	
Course Structure: Lectures: 3 Labs: 0	**Credit Hours: 3**
Prerequisites: None	
Course Outline: Review of Vectors, *Electric Charge:* Coulomb's Law, electric field and intensity, electric potential, capacitors and charge storage concepts, *Magnetism:* magnetic fields, Faraday's and Lenz's Laws, Ampere's law and its applications, Eddy Currents, inductance, induced current and their applications, definitions of the values of AC signals (Average and RMS Values), *Electric and Magnetic circuits:* Electric current, resistance, Ohm's Law, simple resistive circuits (series and parallel), Kirchoff laws, Network theorems (DC analysis), RC and RL circuits. *Fundamentals of Semiconductor physics:* Band theory, semiconductors (intrinsic and extrinsic), pn junction, pn- junctions as a rectifier.	
Reference Material: *University Physics* by Freedman and Young (10 th and higher editions), *Colege Physics* by Resnick, Halliday and Krane (6th and higher edition)	

Course Name: Linear Algebra and Applications	
Course Structure: Lectures: 3 / Labs: 0	**Credit Hours:** 3
Course Outline: Vectors, Vector Spaces, Matrices & Determinants, Cofactor and Inverse, Rank, Linear Independence, Solution of Linear systems, Gaussian Elimination, Positive Definite matrix, Linear Transformations, Operations on matrices, Inner products, Eigenvalues & Eigenvectors. Applications to Systems of Equations and to Geometry.	
Reference Material: *Linear Algebra,* David C Lay, Pearson Addison Wesley, 1999, ISBN: 0201660369	

Computing-General Education (16 Credits Hours)

Course Name: Functional English	
Course Structure: Lectures: 3 / Labs: 0	**Credit Hours:** 3
Prerequisites: None	
Objectives: To develop good English writing, language usage and reading skills.	
Course Outline: Principles of writing good English, understanding the composition process: writing clearly; word, sentence and paragraph. Comprehension and expression. Use of grammar and punctuation. Process of writing, observing audience analysis, collecting, composing, drafting and revising, persuasive writing, reading skills, listening skills and comprehension, skills for taking notes in class, skills for exams.	
Reference Material: *Warriner's English Grammar and Composition,* John E. Warriner	

Course Name: Communication and Presentation Skills	
Course Structure: Lectures: 3 / Labs: 0	**Credit Hours:** 3
Prerequisites: None	
Objectives: To develop good English writing, language usage and reading skills. To appreciate the importance of business communication and to develop understanding of communication concepts, principles, theories and problems. To develop good oral communication and presentation skills.	
Course Outline: Principles of writing good English, understanding the composition process: writing clearly; words, sentence and paragraphs. Comprehension and expression. Use of grammar and punctuation. Process of writing, observing, audience collecting, composing, drafting and revising, persuasive writing, reading skills, listening skills and comprehension, skills for taking notes in class, skills for exams. Business communications; planning messages, writing concise but with impact. Letter formats, mechanics of business, letter writing, letters, memo and applications, summaries, proposals, writing resumes, styles and formats, oral communications, verbal and non-verbal communication, conducting meetings, small group communication, taking minutes. Presentation skills; presentation strategies, defining the objective, scope and audience of the presentation, material gathering material organization strategies, time management, opening and concluding, use of audio-visual aids, delivery and presentation.	
Reference Material: *Business English,* Vawdrey, Stoddard, Bell. 034064629.	

Course Name: Technical and Report Writing	
Course Structure: Lectures: 3 / Labs: 0	**Credit Hours:** 3
Prerequisites: None	
Objectives: To develop efficient literature survey, analysis, report writing and document designing skills.	
Course Outline: Overview of technical reporting, use of library and information gathering, administering questionnaires, reviewing the gathered information. Technical exposition; topical arrangement, exemplification, definition, classification and division, casual analysis, effective exposition, technical narration, description and argumentation, persuasive strategy. Organizing information and generation solution: brainstorming, organizing material, construction of the formal outline, outlining conventions, electronic communication, generation solutions. Polishing style: paragraphs, listening sentence structure, clarity, length and order, pomposity, empty words, pompous vocabulary, document design: document structure, preamble, summaries, abstracts, table of contents, footnotes, glossaries, cross-referencing, plagiarism, citation and bibliography, glossaries, index, appendices, typesetting systems, creating the professional report; elements, mechanical elements and graphical elements. Reports: Proposals, progress reports, Leaflets, brochures, handbooks, magazines articles, research papers, feasibility reports, project reports, technical research reports, manuals and documentation, thesis. Electronic documents, Linear verses hierarchical structure documents.	
Reference Material: Greenfield, T., Research Methods, Guidance for Postgraduates, Arnold, 1996, 034064629.	

Course Name: Islamiat & Pak Studies	
Course Structure: Lectures: 4 / Labs: 0	**Credit Hours: 4**
Prerequisites: None	
Objectives: To impart an understanding of the fundamental principles and teachings of Islam through study of selected verses of the Quran and Prophetic Sayings. Important facets of the Prophet's life and salient, features of Islamic Civilization. To provide appreciation of other prominent religions, systems of ethics and cultures to prepare students to survive in international and multicultural work place. To take an analytical view in the history and development of Muslim society and culture in the sub-continent, emergence of Pakistan and its constitutional development. To develop an appreciation of the issues and challenges currently being faced in Pakistan. The strengths of its people and strategies to deal with the impediments to progress. International relations of Pakistan	
Course Outline: Fundamentals of Islam. (Aqaid, Ibadat, Islamic Dawah etc.); Ethical values of Islam; Ser ah of the Holy Prophet (PBUH); Islamic Civilization and its affects on humanity. Study of other prominent world religions and ethical systems in comparison with Islamic viewpoint. Multicultural societies. Historical background of Pakistan: Muslim society in Indo-Pakistan, the movement led by the societies, The downfall of Islamic society, The establishment of British Raj- Causes and consequences. Political evolution of Muslims in the twentieth century: Sir Syed Ahmed Khan; Muslim League; Nehru; Allama Iqbal: Independence Movement; Lahore Resolution; Pakistan culture and society, Constitutional and Administrative issues, Pakistan and its geo-political dimension, Pakistan and International Affairs, Pakistan and the challenges ahead.	
Reference Material: *Chaudary M. Ali ,The Emergence of Pakistan, 1967.* *K.K.Aziz,The making of Pakistan, 1976.*	

Course Name: Professional Practices	
Course Structure: Lectures:3 / Labs: 0	**Credit Hours: 3**
Prerequisites: None	
Objectives: A Computing graduate as professional has some responsibilities with respect to the society. This course develops student understanding about historical, social, economic, ethical, and professional issues related to the discipline of Computing. It identifies key sources for information and opinion about professionalism and ethics. Students analyze, evaluate, and assess ethical and professional computing case studies	
Outline: Historical, social, and economic context of Computing (software engineering, Computer Science, Information Technology); Definitions of Computing (software engineering, Computer Science, Information Technology) subject areas and professional activities; professional societies; professional ethics; professional competency and life-long learning; uses, misuses, and risks of software; information security and privacy; business practices and the economics of software; intellectual property and software law (cyber law); social responsibilities, software related contracts, Software house organization	
Resources: *Professional Issues in Software Engineering,* M.F. Bott et al.	

Courses for BS program

Bachelor of Science in Computer Science; BS (CS) Computing
Additional/Core Requirements

40 Credit Hours (Refer to Computing part)

Required Computer Science Courses					
#	Code	Preq	Course Title	Credit hours	Proposed Semester
12	CS	2	Computer Organization and Assembly Language	4 (3-1)	4
13	CS	4	Theory of Automata & Formal Languages	3 (3-0)	6
14	CS	5	Analysis of Algorithms	3 (3-0)	6
15	CS	-	Artificial Intelligence	3 (3-0)	5
16	CS	12	System Programming	3 (3-0)	5
17	CS	5	Numerical and Symbolic Computation **(19/130)**	3 (3-0)	7
Elective Computer Science Courses (Not Limited to the List below)					
		Area	**Course**		
18	CS	**Numerical Computation**	Numerical Computing	3 (2-3)	5
19	CS	**Computer Graphics**	Computer Graphics	3 (2-3)	6
20	CS	**Software Engineering**	Software Engineering-II	3 (3-0)	5
21	CS	**Languages and Translators**	Compiler Construction	3 (2-3)	7
22	CS		Principles of Programming Languages	3 (2-3)	4
23	CS	**Computer/ Communication Networks**	Data Communication	3 (3-0)	6
24	CS		Distributed Computing	3 (2-3)	6
25	CS		Data and Network Security	3(3-0)	7
26	CS		Wireless Networks	3(2-3)	
27	CS	**Visual Programming**	Visual Programming	3 (2-3)	7

28, 29	CS	**Computer Architecture**	Computer Architecture	3(3-0)	
			Microprocessor Interfacing	3(3-0)	
30	CS	**Signal Processing**	Digital Signal Processing	3(3-0)	
31	CS		Digital Image Processing	3(3-0)	
32	CS	**Web Engineering**	Web Engineering	3 (3-0)	5
33	CS	**Systems Software**	System Programming	3 (3-0)	7
34	CS	**Database Systems**	Distributed Database Systems	3 (3-0)	7
35	CS			3(3-0)	6-7
36	CS	**Human Computer Interaction (HCI)**	Human Computer Interaction	3(3-0)	6-7
			(21/130)		

Computing Requirements-Supporting Sciences 12 Credit Hours (Refer to Computing part)

Required Supporting Courses					
5	PH	38	Physics – II	3 (3-0)	4
6	ST		Multivariate Calculus	3(3-0)	4
7	ST	-	Differential Equations **(9/130)**	3 (3-0)	5

Computing Requirements-General Education 12 Credit Hours (Refer to Computing part)

University Electives-Recommended Courses (Not Limited to the List below)					
46	MG	-	Financial Accounting		
47	MG	-	Financial Management	3 (3-0)	4
48	MG	-	Human Resource Management	3 (3-0)	5
49	MG	-	Marketing	3 (3-0)	6
50	SS	-	Economics	3 (3-0)	7
51	PS	-	Psychology	3 (3-0)	6
52	SS	-	International Relations	3 (3-0)	7
53	SS	-	Foreign Language (French, German, etc.)	3 (3-0)	7-8
54	SS	-	Philosophy	3(3-0)	6-8
			(18/ 130)		

BS Computer Science Courses (Core)

Course Name: Computer Organization and Assembly Language	
Course Structure: Lectures: 3 / Labs: 3	**Credit Hours: 4**
Prerequisites: Digital Logic Design	
Objectives: The main objective of this course is to introduce the organization of computer systems and usage of assembly language for optimization and control. Emphasis should be given to expose the low-level logic employed for problem solving while using assembly language as a tool. At the end of the course the students should be capable of writing moderately complex assembly language subroutines and interfacing them to any high level language.	
Course Outline: Objectives and Perspectives of Assembly Language, Microprocessor Bus Structure: Address, Data and Control, Memory Organization and Structure (Segmented and Linear Models), Addressing Modes, Introduction to the Assembler and Debugger, Introduction to Registers and Flags, Data Movement, Arithmetic and Logic, Programme Control, Subroutines, Stack and its operation, Peripheral Control Interrupts, Interfacing with high level languages, Real-time application.	
Reference Material: Assembly Language for Intel-Based Computer, Third Edition, 1999, by Kip R. Irvine. Prentice-Hall Publishing, 1999	

Course Name: Theory of Automata and Formal Languages	
Course Structure: Lectures: 3 / Labs: 0	**Credit Hours:** 3
Prerequisites: Discrete Mathematical Structures	
Objectives: The course aims to develop an appreciation of the theoretical foundations of computer science through study of mathematical & abstract models of computers and the theory of formal languages. *Theory of formal languages* and use of various abstract machines as 'recognizers' and parsing will be studied for identifying/validating the synthetic characteristics of programming languages. Some of the abstract machines shall also study as 'Transducers'.	
Course Outline: *Finite State Models:* Language definitions preliminaries, Regular expressions/Regular languages, Finite automata (FAs), Transition graphs (TGs), NFAs, kleene's theorem, Transducers (automata with output), Pumping lemma and non regular language *Grammars and PDA:* Context free grammars, Derivations, derivation trees and ambiguity, Simplifying CFLs , Normal form grammars and parsing, Push-down Automata, Pumping lemma and non-context free languages, Decidability, Chom sky's hierarchy of grammars *Turing Machines Theory:* Turing machines, Post machine, Variations on TM, TM encoding, Universal Turing Machine, Context sensitive Grammars, Defining Computers by TMs.	
Reference Material: *Introduction to Computer Theory,* Denial Cohen, John Wiley & Sons, Inc. *Introduction to Automata Theory, Languages and Computation,* J Hopcraft, D. Ullman. *Languages and Machines, An Into to the Theory of Comp. Sc.,* 2/e Thomas A. Sudkamp, Addison Wesley.	

Course Name: Analysis of Algorithms	
Course Structure: Lectures: 3 / Labs: 0	**Credit Hours:** 3
Prerequisites: Discrete Mathematical Structures, Data Structures	
Objectives: Detailed study of the basic notions of the design of algorithms and the underlying data structures. Several measures of complexity are introduced. Emphasis on the structure, complexity, and efficiency of algorithms.	
Course Outline: Introduction; Asymptotic notations; Recursion and recurrence relations; Divide-and-conquer approach; Sorting; Search trees; Heaps; Hashing; Greedy approach; Dynamic programming; Graph algorithms; Shortest paths; Network flow; Disjoint Sets; Polynomial and matrix calculations; String matching; NP complete problems; Approximation algorithms.	
Reference Material: *Introduction to Algorithms,* T. H. Cormen, C. E. Leiserson, and R. L. Rivest, MIT	

Course Name: Artificial Intelligence	
Course Structure: Lectures: 3 / Labs: 0	**Credit Hours: 3**
Prerequisites: Discrete Mathematical Structures	
Objectives: This course focuses on the set of computational tools and techniques, which mimic the human decision-making process and capability.	
Course Outline: Introduction to Common Lisp. AI classical systems: General Problem Solver, rules, simple search, means-ends analysis. ELIZA, pattern matching, rule based translators, OPS-5. Knowledge Representation: Natural language, rules, productions, predicate logic, semantic networks, frames, objects, scripts. Search: Depth first search, breadth first search, best first search, hill climbing, min-max search, A* search. Symbolic Mathematics: student, solving algebra problems, translating English equations, solving algebraic equations, simplification rules, re-write rules, meta-rules, Macsyma, PRESS, ATLAS. Logic Programming: Resolution, unification, horn-clause logic, Prolog, Prolog programming. Sample case studies of shells and Knowledge Based Systems. A brief appreciation of state of the art computational techniques like neural networks, genetic algorithm, fuzzy sets.	
Reference Material: *Artificial Inteligence* by Luger, 4th edition, Pearson Education.	

Course Name: Numerical and Symbolic Computation	
Course Structure: Lectures: 2 / Labs: 3	**Credit Hours:** 3
Prerequisites: Data Structures	
Objectives: On completion of this unit, students will be able to demonstrate programming proficiency using structured programming techniques in suitable programming languages and implement numerical solutions using computer-based techniques.	
Course Outline: Mathematical Preliminaries, Solution of Equations in one variable, Interpolation and Polynomial Approximation, Numerical Differentiation and Integration, Initial Value Problems for Ordinary Differential Equations, Direct Methods for Solving Linear Systems, Iterative Techniques in Matrix Algebra, Solution of non-linear equations. Approximation Theory. Eigenvalues and Eigenvector computation.	
Reference Material: *Elements of Numerical Analysis,* Dr. Faiz, M. Afzal	

Course Name: System Programming	
Course Structure: Lectures: 2 / Labs: 3	**Credit Hours:** 3
Prerequisites: Computer Organization and Assembly Language	
Objectives: Demonstrate mastery of the internal operation of Unix system software including assemblers, loaders, macro-processors, interpreters, inter-process communication.	
Course Outline: System Programming overview: Application Vs. System Programming, System Software, Operating System, Device Drivers, OS Calls. Window System Programming for Intel386 Architecture: 16 bit Vs 32 bit, Programming, 32 bit Flat memory model, Windows Architecture. Virtual Machine (VM)Basics, System Virtual Machine, Portable Executable Format, Ring O Computer, Linear Executable format, Virtual Device Driver (V + D), New Executable format, Module Management, COFF obj format 16 bit. (Unix) other 32-bit O.S Programming for I 386; Unix Binaryble format (ELF), Dynamic shared objects, Unix Kernel Programming (Ring O), Unix Device Architecture (Character & Block Devices), Device Driver Development, Enhancing Unix Kernel.	
Reference Material: *The UNIX Programming Environment,* B. Kernighan & R. Pike Prentice-Hall, 1984. *System Software,* Leland L. Beck, Addison-Wesley Longmsan, 1990, ISBN: 0-201-50945-8.	

BS Computer Science Courses (Elective)

Course Name: Compiler Construction	
Course Structure: Lectures: 3 / Labs: 0	**Credit Hours:** 3
Prerequisites: Theory of Automata and Formal Languages	
Objectives: At the end of the course students should understand the overall structure of a compiler, and will know significant details of a number of important techniques commonly used. They will be aware of the way in which language features raise challenges for compiler builders.	
Course Outline: Compiler techniques and methodology. Organization of compilers. Lexical and syntax analysis. Parsing techniques. Object code generation and optimization, detection and recovery from errors. Contrast between compilers and interpreters.	
Reference Material: Compiler Design and Construction, *by Alfred V. Aho, Ravi Sethi, Hardcover 2nd edition,* *1987, Van Nostrand Reinhold; ISBN: 0317636367.*	

Course Name: Systems and Network Administration	
Course Structure: Lectures: 3 / Labs: 3	**Credit Hours: 4**
Prerequisites: Computer Networks, Operating System	
Objectives: This course on Systems & Network Administration focuses on to provide theoretical & practical knowledge required to perform administration of computer systems and networks.	
Course Outline: Describe the role/scope of a system and network administrator, Install various operating systems, Manage computer systems and undertake operational tasks, Provide network services to users, Identify security policies and to apply necessary preventive & corrective steps to secure a system/network and apply scripting tools for automating system administration	
Reference Material: *The Practice of System and Network Administration, Second Edition* by Thomas A. Limoncelli, Christina J. Hogan and Strata R. Chalup	

Course Name: Computer Architecture	
Course Structure: Lectures: 3 / Labs: 0	**Credit Hours: 3**
Prerequisites: Digital Logic Design, Computer Organization and Assembly Language	
Course Outline: Introduction Computer Organization and Architecture, Structure and Function, **History of Computer Evaluation**: Generation of Computer, Von Neumann Machine Architecture **Execution:** Introduction of Execution Unit (EU), Register Section, General Register Design **Processor Control Unit**: Basic Concepts Design Methods (Hardwired Control Design and Micro Programmed Control Unit **Cache Memory:** Characteristics of Memory System, Location, Capacity, Unit of Transfer, Access Method, Performance, Physical Type, Physical Characteristics, Organization **Memory Hierarchy:** Cache Memory Principles ,Elements of Cache Design **Internal Memory** Organization, DRAM vs SRAM, Types of ROM **External Memory** Magnetic Disk**,** RAID, RAID Level 0 to 6 **Advanced Topics**: Programmed I/O , Interrupt Driven I/O, DMA (Direct Memory Access)	
Reference Material: **Books:** *1. M. Moris Mano, Modern Computer architecture, 3rd Edition, Prentice Hall, 1992.* *2. William Stallings, Computer Organization and Architecture, 7th Edition*	

Course Name: Software Project Management	
Course Structure: Lectures: 3 / Lab 0	**Credit Hours: 3**
Prerequisites: Data Structures, Software Engineering–I	
Objectives: To develop ability to plan and manage software development projects successfully, maximizing the return from each stage of the software development life cycle.	
Reference Material: *Software Project Management,* Richard H. Thayer, Wiley IEEE Press 2002, ISBN 0-7695-1199-6. *Software Engineering:* A Practitioner's Approach, 4th edition, Roger S. Pressman, McGraw-Hill Higher Education, ISBN: 0070521824.	

Course Name: Computer Graphics	
Course Structure: Lectures: 3 / Labs: 0	**Credit Hours: 3**
Prerequisites: Object Oriented Programming	
Objectives: Study of various algorithms in computer graphics and their implementation in any programming language.	
Course Outline: Graphics hardware. Fundamental algorithms. Applications of graphics. Interactive graphics programming — graph plotting, windows and clipping, and segmentation. Programming raster display systems, panning and zooming. Raster algorithms and software — Scan-Converting lines, characters and circles. Region filling and clipping. Two and three dimensional imaging geometry and transformations. Curve and surface design, rendering, shading, colour and animation.	
Reference Material: 1. Computer Graphics, Principles and Practice, J. D. Foley, A. van Dam, S. K. Feiner and J. F. Hughes, Addison-Wesley ISBN: 0-201-12110-7. *2. Computer Graphics,* F.S.Hill, Maxwell MacMillan ISBN: 0-02-354860-6.	

Course Name: Network Management	
Course Structure: Lectures: 3 Labs: 0	**Credit Hours: 3**
Prerequisites: Computer Networks	
Objectives: The objective of this course is to that students learn and a have hands-on experience of establishing, managing, troubleshooting and maintaining computer networks.	
Course Outline: Introduction, Overview of Network operating system, Setting up a network server, Setting up network clients, Network design issues, Network client administration, Workgroup and Domain concepts. System Administration Basics, Network Services, Monitoring and logging of various operating system events, security applications and general system events, Monitoring wide variety of system objects, Diagnosing and Troubleshooting hardware, networking and various operating system services, System configuration including screen display, network services, bindings, protocols, servers, services and system devices, User and group management and services used to manage user access to resources, Remote administration, Management of key processes, Network services administration including e-mail, internet, web and ftp, Heterogeneous network environment, Firewall administration, Controlling access to the machines.	
Reference Material: *Network Management — A Practical Perspective,* 2nd Edition, Allan Leinwand and Karen Fang Conroy, Addison Wesley Professional, ISBN: 0-201-60999-1.	

Course Name: Database Administration	
Course Structure: Lectures: 3 / Labs: 0	**Credit Hours: 3**
Prerequisites: Data Base Systems	
Objectives: The student will learn the design, algorithms and techniques involved in distributed database system and their implementation.	
Course Outline: Advanced data models. Conceptual Database design. Concurrency control techniques. Recovery techniques. Query processing and optimization. Integrity and security. Client-Server architecture. Distributed database systems. Current trends in database systems. Database machines.	
Reference Material: Distributed Databases: Principles and System, *Ceri and Pelagatti McGraw-Hil Book Company 1984, ISBN: 0-07-010829-3.*	

Course Name: Visual Programming	
Course Structure: Lectures: 3 / Labs: 3	**Credit Hours: 4**
Prerequisites: Data Structures, Data and Network Security	
Objectives: To development applications using various tools and APIs in visual programming.	
Course Outline: Introduction to Windows programming, Use of Windows API, MFC Class hierarchy, Class Wizard, Application Wizard and Application Studio, Graphics Device Interface, Menus, document view architecture, Multiple Views, files and archiving mechanisms, converting Windows programmes to MFC, Sub-classing controls.	
Reference Material: *MFC from the Ground Up.* *Windows 98 API Programming.* *VC+ + A complete References.*	

Course Name: Multimedia Technologies	
Course Structure: Lectures:3 Labs:0	**Credit Hours:** 3
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. Introduction to Multi-media Networks.	
Reference Material: *Multimedia Systems Design,* 1/e, Andleigh, P.K. and Thakrar, K., Prentice Hall.	

Course Name: Information Security	
Course Structure: Lectures: 3 / Labs: 0	**Credit Hours: 3**
Objectives: This course provides a broad overview of the threats to the security of information systems, the responsibilities and basic tools for information security, and the levels of training and expertise needed in organizations to reach and maintain a state of acceptable security. It covers concepts and applications of system and data security. Areas of particular focus include secure network design, implementation and transition issues, and techniques for responding to security breaches.	
Course Outline Information Security Attacks & Vulnerabilities, Anatomy of Attack, Awareness and Management Commitment to Security, Security Policy, Information Security Network Architecture Design Rules, Rules for Selecting Security Hardware & Software, Physical Security Rules, Network Hardware Security, Operating System Security Rules, PC Operating Security Rules, Internet Security Rules, Application Security Rules, Software Validation and Verification Rules, Data Encryption Rules, Configuration Management Rules, Network Monitoring Rules, Maintenance and Troubleshooting Security Rules, Emergency Rules Attacks, An introduction to confidentiality, integrity, availability; authentication technologies and models, Controls and protection models, Security kernels, Secure programming, Information Auditing, Intrusion detection and response, Operational security issues, Physical security issues, Personnel security, Policy formation and enforcement, Access controls, Information flow, Legal, privacy and social issues, Identification and authentication in local and distributed systems; classification and trust modelling, Risks and vulnerabilities, Risk assessment, Database security, Encryption, Host-based and network-based security issues, Areas of particular focus include secure network design, implementation and transition issues, and techniques for responding to security breaches.	
Reference Material: Information Security Best Practices by George L. Stefanek, 2006.	

Course Name: Web Technologies	
Course Structure: Lectures: 3 Labs: 3	**Credit Hours: 4**
Objectives: Design and implementation of web based applications.	
Course Outline: Overview of Protocols: TCP/IP, HTTP, Overview of 3-tier Architecture, Web Based Applications Architecture. Developing Front End Applications: Front End Development Tools, HTML, DHTML, Scripting (Java Script, Jscript, Vbscript), Java Applets, ActiveX.	
Reference Material: *Web enabled Commercial Application Development Using…HTML, DHTML, JavaScript, Perl, CGI,* Ivan Bayross, BPB Publications.	

Course Name: Modern Programming Languages	
Course Structure: Lectures: 3 Labs: 1	**Credit Hours:4**
Objectives: As a senior level course, this course aims at uplifting students' approach and thinking of software development process and tools in general and programming in particular.	
Course Outline: Developing Back End Applications: Java Servlets, CGI/Perl Programming, Cold Fusion, Gateway Interface. Database Connectivity: DBC, ODBC. Performance & Security Issues: E-Commerce Application Security, Presentations, Projects.	
Reference Material: Modern Programming Languages: A Practical Introduction, *Adam Webber, ISBN: 1 -887902-76-7.*	

Course Name: Network Strategies	
Course Structure: Lectures 3/ Labs: 0	**Credit Hours: 3**
Prerequisites: Computer Networks	

- **OSI Model:** The Layers Concepts, TCP/IP Protocol Suite
- **Switching Techniques:** Circut switching, Packet switching, Virtual Circut Switching, Frame Relay, ATM
- **Application Layer:** Domain Name System (DNS)**,** Simple Mail Transfer Protocol (SMTP), Hypertext Transfer Protocol (HTTP)
- **Transport Layer:** User Datagram Protocol (UDP)**,** User Datagram Format**,** UDP Operation, Uses of UDP**,** Transmission Control Protocol (TCP)**,** TCP Features**,** TCP Connection
- **Network Layer:** Distance Vector Routing, Routing Information Protocol (RIP)**,** Link State Routing, Open Shortest Path First (OSPF)**,** Path Vector Routing**,** Border Gatway Protocol (BGP)**,** Internet Protocol (IP)**,** IPV4 Addresses**,** IPV6**,** Transition from IPV4 to IPV6**,** Introduction to ICMP,IGMP,ARP,RARP
- **DataLink Layer:** High-Level Data Link Control (HDLC)**,** Transfer Modes (NRM,ABM)**,** Frame Structure**,** Point to Point Protocol (PPP)**,** PPP Services, Frame format

Reference Books:

1. Data Communications and Networking 4th Edition by Behrouz A.Forouzan
2. Data and Computer Communication 5th Edition By William Stalling.

Course Name: Advanced Object Oriented Programming	
Course Structures Lectures: 3 **Labs:** 3	**Credit Hours: 4**
Introduction to java History of java, Features of java, Java Environment-How it works, Comparison between java and C++, Basic object oriented concepts, Modifiers for (class, methods and variables) Basic java data types, syntax,Writing simple java console applications.,Control structures. (if, if-else, nested if-else, switch, for, while, do-while),Examples of java applications Packages and interfaces, Overview of Java Packages**,** What is java package? Packages levels**,** Why we use packages? Creating packages(Syntax of packages) Default package. Example of packages, What is interface? Why we use interface? Syntax and example of interface. Comparison between interfaces and abstract class. JAVA Exception handling Overview of Exceptions **,**Error and Exceptions**,** Catching a Runtime Exception**,** Handling Multiple Exceptions.**,** The finally Clause**,** The throws Clause**,** When to use Exceptions **,** When not to use Exceptions JAVA Multithreading, Overview of Multithreading**,** The thread control methods**,** The thread life cycle**,** Implementation of Multithreading(EXTENDING A THREAD CLASS) **Applets,** Basics of Java Applet.**,** Advantages and disadvantages of java Applets, Life cycle of java Applet**,** Examples. **AWT** The java Abstract Window Toolkit(AWT) Package. Implantation of AWT controls. **Servlets** Client side vs. Server side technologies.**,** Different Server side technologies, Introduction to Servlets, Servlets life cycle, Software Requirements, Developing Basic Servlets example.**,** doPost, doGet, SSI, Session management.	
Recommended Books: Java Official Tutorial The Complete Reference 5the Edition Java How to Program by Deital and Deital	

Course Name: E-Commerce

Course Structures Lectures: 3 **Labs:** 0	**Credit Hours: 3**

Fundamentals of E-Commerce Technologies: An overview of the principles of E-Commerce. The origin and growth of E-Commerce. Technologies that support the development of E-Commerce applications. Business models and strategies for E-Commerce. Legal issues related to E-Commerce such as privacy, consumer rights and intellectual property.

Electronic Payments Systems: Electronic money, electronic contracts, micro-payments, authenticity, integrity and reliability of transactions, the encryption and digital signature techniques available to support secure transactions on the internet.

Cryptography, Information Security and E-Commerce: Symmetric cryptography, Asymmetric cryptography, Digital signature, one-way hashing, zero-knowledge proof, certificate and certificate authority. Secure information infrastructure, virtual private network (VPN), online shopping and payment systems, e-crash. Economic impact. Smart card, steganography, time stamping. Cryptanalysis technology. Authentication protocols, analysis and evaluation.

Distributed Systems and Software: Architectural models for distributed systems, server techniques, remote procedure call and multicast communication, emerging standard and platforms (CORBA, DCOM), distributed transactions, concurrency control, reliability and security issues.

Network and Web Programming: Client-server system design; interprocess communication; sockets; blocking and nonblocking I/O; multithreaded process; iterative and concurrent server designs; Web programming includes HTML, JAVA, Web page design and construction.

Open Systems for E-Commerce: Introduction to open system standards and protocols. Transaction protocols. Electronic commerce applications using open system and artificial intelligence technologies. Application of intelligent agents for automated transaction processing. Integration of Web programming techniques with information and communication systems.

Project in E-Commerce Technologies: An individual or a team project on E-Commerce technologies. *Project in E-Commerce Technologies are designed to allow students to gain first hand experience in studying and developing real-world systems for E-Commerce. These could be conducted either individually or by teamwork. Possible projects include, but are not limited to: On-line Banking and Financial Systems Supply Chain, Web-based Forecasting and pricing Electronic Payment Systems, Internet Shopping, Virtual Store or Virtual Campus, Electronic Office, Cryptography Servers, Security Fire Wall, Network Management and Quality of Service, Distributed System Technologies in CORBA or DCOM,

HTML(Hypertext Markup Language): Internet, web & HTMLK Fundamentals, The world Wide Web & Web Servers,

Creating Static Web Pages with HTML:

Advanced HTML:

Java Script: Data Type, Control Structures, Object & Function, Event Handling,

VB Script: Introduction, Data Types, Syntax, Control, etc,

Active Server Pages:

Common Gateway Interface (CGI) Script:

Database Connectivity: Using ASP, Using CGI,

Recommended Books:

Ann Navarro, Todd Stauffer, HTML by Example

Andrew Wooldrige, Mike Morgan, Mona Everett, Scott J. Walter, Special Edition Using Java Script

Course Name: Software Engineering-II	
Course Structures: Lectures: 3 Labs: 0	**Credit Hours: 3**

Course Contents: Object Oriented Analysis and Design

Introduction Introduction to Software engineering –II, Why software engineering-II, Software Crises

Basic concepts of OO software Engineering-II, Object Oriented paradigm, Abstraction, Objects, Classes

Inheritance, Polymorphism Encapsulation

Object Modeling, Define Model, Objects & Class, Links & Associations,Generalization & Inheritance

Grouping Constructs, Aggregation, Abstract Class, Multiple Inheritance, Meta Data, Candidate Key

Object oriented development, Introduction, How to Identify objects,How to Identify association, How to Identifying multiplicities

Object Oriented Metrics, Introduction, Metrics Suite for Objected Oriented design, The MOOD Metrics

Object Oriented Testing, Introduction, MM testing, Function pair Coverage

Formal Notations, Introduction, Formal Specification, Object Constraint Language (OCL), UML

Case Study: Compiler Design Using object oriented approach, submit a detail report on Compiler design. (Draw UML Diagrams) which clearly show the

Books:

1. *Software Engineering DAVID GUSTAFSON,P.hD,schaum's Outline Series*

James R.Rumbaugh, Michael R.Blaha, William Premerlani, Frederick Eddy, William Lorensen,Object Oriented Modeling and Design with UML, 2nd Edition, Prentice Hall, 2004

Course Name: Telecommunication Systems	
Course Structure: Lectures:3 Labs:0	Credit Hours: **3**

Introduction To Unguided Media ,Microwaves, Radio waves, Infrared

Introduction To Wireless Communication Systems, Evolution of mobile Radio Communications Mobile radio systems around the world

Example of Wireless communication systems, Paging systems, Cordless telephone systems, Cellular telephone systems, How a cellular telephone call is made

Modern Wireless Communication Systems, Second generation (2G) cellular networks Evolution to 2.5G wireless networks, Evolution for 2.5G TDMA standards , HSCSD for 2.5G GSM, GPRS for 2.5G GSM and IS – 136, EDGE for 2.5G GSM and IS – 136IS-95B for 2.5G CDMA, Third generation (3G) wireless networks ,3G W- CDMA (UMTS), 3G cdma 2000, 3G TD-SCDMA, Bluetooth and personal area network

The Cellular Concept----- System Design Fundamentals, Introduction ,Frequency reuse, Channel assignment strategies, Handoff strategies, Prioritizing Handoffs ,Practical Handoffs Consideration , Interference and system capacity ,Co-Channel Interference & system capacity , Improving Coverage & Capacity in Cellulaer Systems , Cell Splitting ,Sectoring , A Microcell Zone Concept

Mobile Radio Propagation: Large- Scale Path Loss , Introduction to radio wave propagation , Free space propagation model

Multiple Access Techniques For Wireless Communications

Introduction to multiple access, Frequency division multiple access (FDMA) Time division multiple access (TDMA), Spread spectrum multiple access Frequency hopped multiple access (FHMA), Code division multiple access (CDMA)

Advance Topics GSM**,** GSM services and features**,** GSM system architecture Satellite communication, SONNET/SDH

Recommended Books:

Wirless communications (Principles and practice) 2nd Edition by Theodore S. Rappaport.

Data Communication & Networking 4th Edition by Behrouz A.Farouozan

BS Computer Science Courses (Required Supporting Courses)

Course Name: Multivariable Calculus	
Course Structure: Lectures: 3 / Labs: 0	**Credit Hours: 3**
Prerequisites: Calculus and Analytical Geometry	
Objectives: Cover Secondary level to advanced topics in Calculus	
Course Outline: Functions of Several Variables and Partial Differentiation. Multiple Integrals, 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 - Trans form.	
Reference Material: *Calculus and Analytical Geometry By Swokowski, Olinick and Pence.*	

Course Name: Differential Equations	
Course Structure: Lectures: 3 / Labs: 0	**Credit Hours: 3**
Prerequisites: Multivariate Calculus	
Objectives: Develop fundamental skills of solving ordinary differential equations, and developing differential equations for real-world problems.	
Course Outline: Ordinary Differential Equations of the First Order: Geometrical Considerations, Isoclines, Separable Equations, Equations Reducible to Separable Form, Exact Differential Equations, Integrating Factors, Linear First-Order Differential Equations, Variation of Parameters. Ordinary	
Linear Differential Equations; Homogeneous Linear Equations of the Second Order, Homogeneous Second-Order Equations with Constant Coefficients, General Solution, Real Roots, Complex Roots, Double Root of the Characteristic Equation, Differential Operators, Cauchy Equation, Homogeneous Linear Equations of Arbitrary Order, Homogeneous Linear Equations of Arbitrary Order with Constant Coefficients, Non-homogeneous Linear Equations. Modelling of Electrical Circuits. Systems of Differential Equations. Series Solutions of Differential Equations. Partial Differential Equations: Method of Separation of variables, wave, Heat & Laplace equations and their solutions by Fourier series method.	
Reference Material: Advanced Engineering Mathematics, Michael Greenberg, ISBN: 0133214311. Advanced Engineering Mathematics,7/e, Erwin Kreyszig. John Wiley & Sons 1992 ISBN: 0471553808. A First Course in Diferential Equations, Zill, Prindle, Weber and Schmidt. Brooks/Cole Publishing, 1996. ISBN: 0534955746.	

BS Computer Science Courses (Elective General Courses)

Course Title: Basic Electronics	
Course Structures: Lectures: 3 Labs: 0	Credit Hours: **3**
Direct Current Circuits Joules' Law, Circuit Analysis, Kirehhoff's Rules, Wheatstone Bridge Alternating Currents Sinusoidal Signals, Frequency, amplitude and phase, uns, value, power factor. Capacitive reactance, Inductive reactance, RL Filter, RC Filter, Diffenitiating and integrating factor Transient currents, Transition and Diffusion Capacitance, Reese Recovery Time, Zener Diode, Light Emitting Diode. Diode Applications Load Line Analysis, Series/Parallel and Series-Parellel Configurations., AND/OR Gates, Half wave and full wave rectifier., Clippers and clampers, Voltage multiplier circuits, junction. Transistor Transistor Construction, Transistor Operation, Different Configurations, Transistor amplifying action, Limits of Operations, DC Biasing, Fixed Bias Circuit, Emitter Stabilized bias circuit, Voltage Divider biased, BJT transistor Modeling, BJT small signal analysis Amplifiers Differential and Common mode operation, Op-amp basic, Op-amp application	
Reference Material *1.James J. Brophy, Basic Electronics for Scientists, 5th Edition, McGraw Hill Publishing Company Inc, 1990.* *2.Basic Electronics and Circuit Theory by Nashalsky*	

Course Title: Rich Internet Applications	
Course Structures: Lectures: 3 Labs: 1	Credit Hours: **4**

Course Description:
The Rich Internet Applications (RIA) course concentrates primarily on the theory and practice of building cross platform rich client web applications in the browser for desktop and mobile devices. This course explores the new category of engaging web applications being developed using tools such as Flex, Flash ActionScript, AJAX and Silverlight. Rich Internet Applications (RIAs) can combine rich media (such as video, audio, and animation) to achieve powerful data visualizations. Along with the fundamentals underlying these technologies, several applications will be showcased as case studies. Students work with these technologies starting with simple applications and then examining real world complex applications. At the end of this course, students would have mastered the latest and widely used RIA methodologies.

Objectives: Build and deploy cross-platform Rich Internet Applications (RIA) and content, Create engaging animations to attract and retain users, Generate interactive dynamic content and special effects, Connect to relational databases and XML datasets to build real-time, data-driven applications, Encode and deliver streaming video to create innovative, mixed-media content, Integrate and distribute Flash content on multiple platforms, including DVD, web and Mobile

Course Outline: Rich Internet Applications: Introduction, History, Evolution
RIA Tools and their Features: Flash, Flex, Actionscript, Adobe Air, and Silverlight
RIA APIs and IDEs HTML5: Overview of HTML5, Canvas and Scalable Vector Graphics, Audio and Video, Geolocation, Communication, Web Sockets, Forms, Drag and Drop, Web Workers, Web Storage, Offline Web Applications, CSS AJAX: Purpose, Frameworks, XML, JSON, DOM, XMLHttpRequest Object jQuery UI: jQuery Review, Controls, Drag and Drop jQuery Mobile: Navigation, Form Elements and Lists, Views, Server Integration Techniques Flex: Flex Programming elements, MXML, Events, Data Access, User Interface Components, Flex Mobile
Project Presentations

Reference Material

Pro HTML5 Programming, 2nd edition, by Peter Lubbers, Brian Albers, and Frank Salim, APress, 2011. ISBN13: 978-1-4302-3864-5.
Head First HTML5 Programming, Building Web Apps with JavaScript, Eric Freeman and Elisabeth Robson, O'Reilly, 2011. ISBN 13: 978-1-4493-9054-9.
jQuery UI, by Eric Sarrion, O'Reilly, 2012. ISBN 13: 978-1-449-31699-0
jQuery Mobile: Up and Running, by Maximiliano Firtman, O'Reilly, 2012. ISBN 13: 978-1-449-39765-4.
Adobe Flex 4.5 Fundamentals: Training from the Source, by Labriola, M. and Tapper, J., Adobe Press, 2011. ISBN 13: 978-0-321-77712-6 (Reference book)
Flex Mobile in Action, by Jonathan Campos, Manning Publications, 2012. ISBN 13: 9781617290619
Various online resources