

GC UNIVERSITY, FAISALABAD



# Scheme of Studies

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BS (Honors) Information Technology

*8 Semesters / 4 years Degree Program  
for the year 2014 and onward*

**Department of Information Technology**

**Road Map BS (IT) 2014-18 and onward**

<b>Semester-1</b>			
<b>Sr #</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Credit Hours</b>
1	CIT-301	Programming Fundamentals	4 (3-1)
2	CIT-303	Introduction to Information and Communication Technologies	4(3-1)
3	ENG-305	English-I (Functional English)	3 (3-0)
4	ISL- 307	Islamic Studies	3 (3-0)
5	MTH-309	Calculus and Analytical Geometry	3 (3-0)
		<b>Total</b>	<b>17</b>

<b>Semester-2</b>			
<b>Sr #</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Credit Hours</b>
1	CIT-302	Object Oriented Programming	4 (3-1)
2	CIT-304	Discrete Structures	3 (3-0)
3	CIT-306	Fundamentals of Information Technology	3 (3-0)
4	ENG-308	English-II (Technical and Report Writing)	3 (3-0)
5	STA-310	Probability and Statistics	3 (3-0)
6	EEE-311	Basic Electronics	3 (3-0)
		<b>Total</b>	<b>19</b>

<b>Semester-3</b>			
<b>Sr #</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Credit Hours</b>
1	CIT-401	Data Structure and Algorithms	3 (2-1)
2	CIT-403	Digital Logic and Design	3 (2-1)
5	CIT-405	Introduction to Database Systems	4 (3-1)
3	CIT-407	Theory of Automata & Formal Languages	3 (3-0)
4	ENG-409	English-III (Communication Skills)	3 (3-0)
6	PAK-411	Pakistan Studies	3(3-0)
		<b>Total</b>	<b>19</b>

<b>Semester-4</b>			
<b>Sr #</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Credit Hours</b>
1	CIT-402	Operating Systems	3 (2-1)
2	CIT-404	Computer Organization and Assembly Language	3 (2-1)
3	MTH-406	Linear Algebra	3 (3-0)
4	ECO-408	Economics	3 (3-0)
5	BBA-410	Organizational Behavior	3 (3-0)
		<b>Total</b>	<b>15</b>

<b>Semester-5</b>			
<b>Sr #</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Credit Hours</b>
1	CIT-501	Introduction to Software Development	3 (3-0)
2	CIT-503	Web Systems and Technologies	3(2-1)
3	CIT-505	Information Systems	3 (3-0)
4	CIT-507	Database Management	3(2-1)
5	CIT-509	Visual Programming	3(2-1)
6	BBA-511	Information System Audit	3(3-0)
		<b>Total</b>	<b>18</b>

<b>Semester-6</b>			
<b>Sr #</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Credit Hours</b>
1	CIT-502	Computer Communications and Networks	3 (2-1)
2	CIT-504	Knowledge Based Systems	3(2-1)
3	CIT-506	Multimedia Systems and Design	3(2-1)
4	CIT-508	Technology Management	3 (3-0)
5	CIT-510	Telecommunication Systems	3(3-0)
6	BBA-512	Marketing	3(3-0)
		<b>Total</b>	<b>18</b>

<b>Semester-7</b>			
<b>Sr #</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Credit Hours</b>
1	CIT-601	Human Computer Interaction	3 (3-0)
2	CIT-603	System Programming	3(2-1)
3	CIT-605	Network Security	3(3-0)
4	CIT-607	System Integration and Architecture	3(3-0)
5	CIT-609	Systems and Network Administration	3(2-1)
<b>Total</b>			<b>15</b>

<b>Semester-8</b>			
<b>Sr #</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Credit Hours</b>
1	CIT-602	Professional Practices	3 (3-0)
2	BBA-604	Human Resource Management	3(3-0)
3	CIT-630	IT Capstone	6 (0-6)
<b>Total</b>			<b>12</b>

**Total Credit Hours:**

**133**

### Semester 1.

<b>Course Name: Programming Fundamentals</b>	
<b>Course Structure:</b> Lectures: 3, Labs: 1	<b>Credit Hours: 4</b>
<b>Prerequisites:</b> None	
<b>Objectives:</b> 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.	
<b>Course Outline:</b> Overview of computers and programming. Overview of language for e.g. C language C. Basics of structured and Modular programming. Basic 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.	
<b>Reference Material:</b>	
1. Problem Solving and Program Design in C / 6E Hanly & Koffman	

Addison-Wesley   Published: 02/06/2009 ISBN-10: 0321535421   ISBN-13: 9780321535429 2. C How to Program, 5/E <b>(Harvey &amp; Paul) Deitel &amp; Deitel</b> , ISBN-10: 0132404168 ISBN-13: 9780132404167 Publisher: Prentice Hall Copyright: 2007
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**Course Name: Introduction to Information and Communication Technologies**

**Course Structure:** Lectures: 2 / Labs: 3      **Credit Hours:** 3

**Prerequisites:** None (first semester course)

**Objectives:**

This course focuses on a breadth-first coverage of the use of computing and communication technologies to solve real life problems; including computing environments, general application software like word processing, visual presentation applications, tabular data manipulation, DBMS, WWW, Email management systems, Virus, Anti-Virus and Spam Protection; Introduction to the basic computing hardware (main building blocks), operating systems, data networks; software engineering and communication technology along with social and ethical issues. An introduction of the program of study in computing for which this course is being taught (CS, IT, SE etc.). The course attempts to provide every student a set of productivity tools that they will be able to use for the rest of their lives.

**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 Communication Technology, Operating system, Compiler, DBMS, Computer networks and internet, WWW, web mail applications, Computer graphics, AI, Viruses and Anti-Viruses, Use of office productivity tools, such as word processors, spreadsheets, presentation applications, etc., Social, Ethical, Professional and Legal Issues, and overview of the complete program of studies in computing and its structure.

**Suggested Text Book:**

1. Introduction to Computers by Peter Norton, 6th Edition, McGraw-Hill SiE, ISBN 0-07-059374-4.

**Reference Material:**

1. Computers: Information Technology in Perspective, 9/e by Larry Long and Nancy Long, Prentice Hall, 2002/ISBN: 0130929891.
2. An Invitation to Computer Science, Schneider and Gersting, Brooks/Cole Thomson Learning, 2000.
3. Information System Today by Leonard Jessup, Joseph Valacich.
4. Computers Today by Suresh K. Basandra.
5. Computer Science: An overview of Computer Science, Sherer.

**Course Name: English-I (Functional English)**

**Course Structure:** Lectures: 3 / Labs: 0      **Credit Hours:** 3

<b>Prerequisites:</b> None
<b>Objectives:</b> To develop good English writing, language usage and reading skills.
<b>Course Outline:</b> 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.
<b>Reference Material:</b> <i>Warriner's English Grammar and Composition</i> , John E. Warriner

<b>Course Name: Islamic &amp; Pakistan Studies</b>	
<b>Course Structure:</b> Lectures: 3 / Labs: 0	<b>Credit Hours:</b> 3
<b>Prerequisites:</b> None	
<b>Objectives:</b> 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	
<b>Course Outline:</b> 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.	
<b>Reference Material:</b> <i>Chaudary M. Ali ,The Emergence of Pakistan, 1967.</i> <i>K.K.Aziz,The making of Pakistan, 1976.</i>	

<b>Course Name: Calculus and Analytic Geometry</b>	
<b>Course Structure:</b> Lectures: 3, Labs: 0	<b>Credit Hours:</b> 3
<b>Prerequisites:</b> None	
<b>Objectives:</b> To provide foundation and basic ground for calculus and analytical geometry background.	
<b>Course Outline:</b> 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:**

1. Swokowski, Olinick and Pence, *Calculus and Analytical Geometry*, 6<sup>th</sup> edition, 1994, Brooks/Cole Publishers.
2. Howard Anton, *Calculus*, 7<sup>th</sup> edition. 2002, John Wiley and Sons (WIE).
3. William E. Boyce Richard C. Diprima, *Calculus*, John Wiley & Sons, ISBN: 0471093335.
4. Thomas Finny, *Calculus and Analytical Geometry*, 10th edition, John Wiley and Sons.
5. Erwin Kreyzig, *Advanced Engineering Mathematics*, 7th edition, 1993, John Wiley & Sons Inc.

**Semester 2.****Course Name: Object Oriented Programming**

**Course Structure:** Lectures: 2, Labs: 1 | **Credit Hours: 3**

**Prerequisites:** Programming Fundamentals

**Objectives:** The course aims to focus on object-oriented concepts, analysis and software development.

**Course Outline:** Evolution of Object Oriented (OO) programming, OO concepts and principles, problem solving in OO paradigm, OO program 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:**

1. C++ How to Program, 6/E  
(Harvey & Paul) Deitel & Deitel ISBN-10: 0136152503 ISBN-13: 9780136152507 Publisher: Prentice Hall
2. Java How to Program, 7/E  
(Harvey & Paul) Deitel & Deitel ISBN-10: 0132222205 ISBN-13: 9780132222204 Publisher: Prentice Hall

**Course Name: Discrete 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. In this course more emphasis shall be given to statistical and probabilistic formulation with respect to computing aspects.

**Course Outline:** Introduction to logic and proofs: Direct proofs; proof by contradiction, Sets, Combinatorics, Sequences, Formal logic, Propositional and predicate calculus, Methods of Proof, Mathematical Induction and Recursion, loop invariants, Relations and functions, Pigeonhole principle, Trees and Graphs, Elementary number theory, Optimization and matching. Fundamental structures:

Functions; relations (more specifically recursions); pigeonhole principle; cardinality and countability, probabilistic methods.	
<b>Reference Material:</b> 1. Kenneth H. Rosen, <i>Discrete Mathematics and Its Applications</i> , 6TH edition, 2006, Mcgraw Hill Book Co.	
<b>Course Name: English-II (Technical and Report Writing)</b>	
<b>Course Structure:</b> Lectures: 3 / Labs: 0	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> None	
<b>Objectives:</b> To develop efficient literature survey, analysis, report writing and document designing skills.	
<b>Course Outline:</b> 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.	
<b>Reference Material:</b> Greenfield, T., <i>Research Methods, Guidance for Postgraduates</i> , Arnold, 1996, 034064629.	

<b>Course Name: Probability and Statistics</b>	
<b>Course Structure:</b> Lectures: 3, Labs: 0	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> None	
<b>Objectives:</b> To introduce the concepts of data analysis, presentation, counting techniques, probability and decision making	
<b>Course Outline:</b> Introduction to Statistics, Descriptive Statistics, Statistics in decision making, Graphical representation of Data Stem-and Lead plot, Box-Cox plots, measures of central tendencies and dispersion, moments of frequency distribution; Counting techniques, introduction to probability, sample space, events, laws of probability, Conditional probability and Baye's theorem with application to random variable (Discrete and continuous) Binomial, Poisson, Geometric, Negative Binomial Distributions; Exponential Gamma and Normal distributions. Regression and Correlation, Estimation and testing of hypotheses, use of elementary statistical packages for explanatory Data analysis.	
<b>Reference Material:</b> 1. Ronald Walpole, Myers, Myers, Ye, "Probability & Statistics for Engineers &	



Scientists”, 8 <sup>th</sup> edition, 2008, <b>Prentice Hall</b> Publisher.	
2. Lay L. Devore, Probability and Statistics for Engineering and the Sciences, 2003, Duxbury Publishers.	
3. G. Cowan, <i>Statistical Data Analysis</i> , 1998, Clarendon, Oxford.	
<b>Course Name: Fundamentals of Information Technology</b>	
<b>Course Structure:</b> Lectures: 3	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> Introduction to Computing (recommended)	
<b>Objectives:</b> To introduce students to the scope of the field of Information Technology, to give them a basic understanding of information, its organization, transmission, storage, retrieval and presentation, and to explore some of the computer based technologies used for these purposes.	
<b>Course Outline:</b> Introduction to the academic discipline of IT as well as the general meaning of IT as per objectives given in the start of this program. Definitions of information, information technology as the use of computer based technology to organize, store, retrieve, transmit and present information, sender/receiver/channel model for information transfer. Information organization via databases, data modeling, and information management systems. Basic network ideas and models. Differences in human and machine processing of information, information transfer at the human/machine interface, modalities for information presentation, advantages and disadvantages of various presentation media. Challenging issues for today’s information and communication technologies, issues in organizational need assessment and management of large scale information systems, along with social, legal and ethical issues related with each topic.	
<b>Suggested Text Book:</b>	
1. Cyganski, David, John A. Orr and Richard F. Vaz, Information Technology Inside and Outside, Pearson Education (LPE), 2001	
2. Information Technology: Principles, Practices, and Opportunities (3rd Edition) (Hardcover), by <a href="#">James A. Senn</a> (Author), Prentice Hall; 3 edition (December 1, 2003), ISBN-10: 0131436260	
<b>Reference Material:</b>	
1. Cyganski, David, John A. Orr and Richard F. Vaz, Information Technology Inside and Outside, Pearson Education (LPE), 2001	
2. Ray, Ajoy Kumar and Tinku Acharya, Information Technology: Principles and Applications, Prentice-Hall India, 2004	
3. Information Technology: Principles, Practices, and Opportunities (3rd Edition) (Hardcover), by <a href="#">James A. Senn</a> (Author), Prentice Hall; 3 edition (December 1, 2003), ISBN-10: 0131436260	
4. Introduction to Information Technology (Hardcover), by <a href="#">Efraim Turban</a> (Author), <a href="#">Rex Kelly Rainer</a> (Author), <a href="#">Richard E. Potter</a> (Author), Hardcover: 592 pages, Publisher:	
5. Wiley; 2 edition (July 12, 2002), ISBN-10: 0471073806	

### Semester 3.

<b>Course Name: Digital Logic And Design</b>	
<b>Course Structure:</b> Lectures: 2 / Labs: 3	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> Discrete Structures, Introduction to Computing	
<b>Objectives:</b> 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.	
<b>Course Outline:</b> 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, subtractors, 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 Machine (ASM) Charts, Asynchronous circuits, Memory systems, Functional organization, Multiprocessor and alternative architectures: Introduction to SIMD, MIMD, VLIW, EPIC; systolic architecture; interconnection networks; shared memory systems; cache coherence; memory models and memory consistency, Performance enhancements, Contemporary architectures.	
<b>Reference Material:</b> <i>Digital Design</i> , 2nd Ed., M. Morris Mano, Prentice Hall, 1991. <i>Practical Digital Logic Design and Testing</i> , P K Lala, Prentice Hall, 1996.	

<b>Course Name: Digital Logic And Design</b>	
<b>Course Structure:</b> Lectures: 2 / Labs: 3	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> Discrete Structures, Introduction to Computing	
<b>Objectives:</b> 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.	
<b>Course Outline:</b> 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, subtractors, 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 Machine (ASM) Charts, Asynchronous circuits, Memory systems, Functional organization, Multiprocessor and alternative architectures: Introduction to SIMD, MIMD, VLIW, EPIC; systolic architecture;	

interconnection networks; shared memory systems; cache coherence; memory models and memory consistency, Performance enhancements, Contemporary architectures.

**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: Communication Skills English III**

**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 nonverbal 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.

**Course Name: Introduction to Database Systems**

**Course Structure:** Lectures: 2/Labs: 3 | **Credit Hours:** 3

**Prerequisites:** Data Structures and Algorithms

**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

**Course Outline:**

Basic database concepts; Logical database Modelling and design: Entity Relationship diagram (ERD), Enhanced ERD Relational data model: mapping ERD to relational model, Functional dependencies and Normalization: 1st -3rd Normal Form and BCNF, Relational Algebra; Structured Query language (SQL); Fundamental knowledge about Transaction processing, concurrency control recovery techniques and query optimization concepts.

<p><b>Reference Material:</b></p> <ol style="list-style-type: none"> <li>1. C. J. Date, Database Systems, Addison Wesley Pub. Co.</li> <li>2. R. Elmasri and S. Navathe. Fundamentals of Database Systems, Benjamin/Cummings.</li> <li>3. Abraham Silberschatz, Henry F. Korth S. Sudarshan. "Database System Concepts".</li> <li>4. T.Connolly and C.Begg . "Database Systems, a Practical Approach to Design, Implementation and Management", Pearson education,.</li> </ol>
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## Semester 4.

<b>Course Name: Operating Systems</b>	
<b>Course Structure:</b> Lectures: 3, Labs: 1	<b>Credit Hours: 4</b>
<b>Prerequisites:</b> None	
<p><b>Objectives:</b> To help students gain a general understanding of the principles and concepts governing the functions of operating systems and acquaint students with the layered approach that makes design, implementation and operation of the complex OS possible.</p>	
<p><b>Course Outline:</b> 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.</p>	
<p><b>Reference Material:</b></p> <ol style="list-style-type: none"> <li>1. <i>Applied Operating Systems Concepts</i>, 7<sup>th</sup> Edition, Silberschatz A., Peterson, J.L., &amp; Galvin P.C. 2004.</li> <li>2. <i>Modern Operating Systems</i>, 3rd Edition, Tanenmaum A.S., 2008.</li> </ol>	

<b>Course Name: Computer Organization and Assembly Language</b>	
<b>Course Structure:</b> Lectures: 2, Labs: 1	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> Digital Logic Design	
<p><b>Objectives:</b> 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.</p>	
<b>Course Outline:</b> Microprocessor Bus Structure: Addressing, Data and Control,	

Memory Organization and Structure (Segmented and Linear Models), 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.

Objectives and Perspectives of Assembly Language, Addressing Modes, Introduction to the Assembler and Debugger, Manipulate and translate machine and assembly code, Describe actions inside the processing chip, Discuss operations performed by an instruction set, Write a fully documented program, Using an assembler of choice.

**Reference Material:**

1. Stallings, "Computer Organization & Architecture", 7<sup>th</sup> ed, Prentice HALL, 2006.
2. Irvine, Assembly Language for Intel-based Computers, 5th ed, Prentice Hall, 2007.
3. Computer Organization and Design, The Hardware/Software Interface, 4th ed, by David A. Patterson and John L. Hennessy, 2008. Elsevier Publishers.

**Course Name: Computer Graphics**

**Course Structure:** Lectures: 2 / Labs: 3 | **Credit Hours:** 3

**Prerequisites:** Object Oriented Programming , Visual 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, Differential Line Algorithm, panning and zooming. Raster algorithms and software — Scan-Converting lines, characters and circles. Scaling, Rotation, Translation, Region filling and clipping. Two and three dimensional imaging geometry (Perspective projection and Orthogonal projection) 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.
3. Interactive Computer Graphics: Functional, Procedural and Device-level methods; Peter Burger and Duncan. F. Gillies; Addison-Wesley, (2003)

**Course Name: Computational Linear Algebra**

**Course Structure:** Lectures: 2 / Labs: 1 | **Credit Hours:** 3

**Prerequisites:** Linear Algebra, Calculus

**Objectives:** Students will gain familiarity with and facility in the use of standard techniques for the numerical solution of a variety of problems in linear algebra, including solutions of linear systems, various matrix operations, evaluation of determinants and permanents, calculation of eigenvalues and determination of eigenvectors. Students will be introduced to various discrete transforms and apply some specific transforms to the solution of simple problems. In all cases, students will be introduced to possible sources of error and techniques for estimating the magnitude.

**Course Outline:** Background matrix algebra, measuring vectors, matrices, subspaces, and linear system sensitivity, numerical matrix algebra, Gaussian elimination, special linear systems, orthogonalization and least squares methods, the unsymmetrical eigenvalues problem, the symmetric eigenvalues problem, Lanczos methods, iterative methods for linear systems, functions of matrices. Introduction of discrete transforms, discrete Fourier and cosine transforms and simple applications. Error analysis and estimation for all techniques studied.

*Sample labs and assignments:*

- Implementation and testing of algorithms for typical linear algebra problems, including an analysis of errors.

**Resources:**

1. Golub, G., and C. Van Loan, *Matrix Computations (3/e)*, 1996
2. Sewell, G., *Computational Methods of Linear Algebra (2/e)*, 2005
3. Nievergelt, Y., *Wavelets Made Easy*, 1999.

## Semester 5.

<b>Course Name: Web Systems and Technologies</b>	
<b>Course Structure:</b> Lectures: 3	<b>Credit Hours:</b> 3
<b>Prerequisites:</b> Fundamentals of Information Technology (required)	
<b>Objectives:</b> 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.	
<b>Course Outline:</b> In-depth study of World Wide Web architectures, protocols and standards (HTTP, HTML, XHTML, CGI, XML, WML, cHTML, etc.), Web Technologies and Tools (such as scripting tools) for web application development and deployment (web servers, application servers, etc.), Web Based Applications including search engines and content management, management of large scale web based information systems, Web Services, Web2, Semantic Web, and Web3, principles of web site design, practical exercise in web site development.	

**Suggested Text Books:**

1. Nuckles, Craig, Web Applications: Concepts and Real World Design, Wiley 2006
2. Programming the World Wide Web (4th Edition) (Paperback), by [Robert W. Sebesta](#) (Author), Paperback: 752 pages, Publisher: Addison Wesley; 4th edition (August 17, 2007), ISBN-10: 0321489691

**Reference Material:**

1. Gosselin, Dan, et. al., The Web Warrior Guide to Web Design Technologies, Cengage Learning, 2003
2. Zak, Diane, et. al., The Web Warrior Guide to Web Programming, Cengage Learning, 2003
3. Leasure, T., Bob Leasure and James Leasure, The Web Warrior Guide to Web Database Technologies, Cengage Learning, 2003
4. Morrison, Mike and Joline Morrison, Database Driven Websites, 2/e, Cengage Learning, 2002
5. Web Wizard series for various technologies, Addison-Wesley
6. Jackson, J. C., Web Technologies: A Computer Science Perspective, Pearson (LPE), 2008
7. [Web Application Architecture: Principles, Protocols and Practices](#) by Leon Shklar and Richard Rosen (Paperback - Oct 31, 2008), Paperback: 420 pages, Publisher: Wiley; 2 edition (October 31, 2008), ISBN-10: 047051860X
8. [Web Engineering: The Discipline of Systematic Development of Web Applications](#) by Gerti Kappel, Birgit Prýýll, Siegfried Reich, and Werner Retschitzegger (Paperback - Jul 5, 2006)

<b>Course Name: Information Systems</b>	
<b>Course Structure:</b> Lectures: 3/Labs: 0	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> None	
<b>Objectives:</b> Major emphasis than is usual for Information Systems analysis, design, and success and management aspects will be placed in order to discuss the management of the technical processes involved. Actual Case Studies will be central to the delivery of the unit. Recent, well-accepted, developments in all aspects of Information Systems development will also be covered and discussed. This course will facilitate students to understand the advanced concepts of information systems.	

<p><b>Course Outline:</b>                  Introduction and Classification of Information Systems, Lifecycle of IS Projects, Major Taxonomies of Information Systems, IS Strategies, Types of IS Strategies, Business Strategies and Types, Alignment of both Strategies, Information Systems success and Failure, Critical Success Factors, Information Systems Project Evaluation, IS Feasibility Study and Types, Managing Information Systems Projects, Structure of IS Projects, Managing Conflicts in Information Systems projects, Role of CIO, System Analysis of IS Projects, Design Issues in IS, Coupling, Cohesion and Structured Charts, Team Composition, Detailed IS Design Issues, Advanced Design Issues, Measuring Project Complexity, Prototype Approaches, CASE Tools, Soft System Methods (SSM), Rapid Application Development (RAD), Case Studies.</p>
<p><b>Reference Material:</b>                  1. Enterprise Information Systems, O'Brien and Marakas, 13th Edition, McGraw-Hill, 2007</p>

<b>Course Name: Data Warehousing</b>	
<b>Course Structure:</b> Lectures: 2/Labs: 3	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> Introduction to Database Systems	
<b>Objectives:</b> (a) to manage large database systems, (b) to monitor the processing of database system.	
<p><b>Course Outline:</b>                  Introduction of the business context for data warehousing and decision support systems. Differences between TPS and DSS environments. Data warehouse Architecture. Data Marts. Differentiate Data Marts and Data Warehouse. Evaluation of Data Warehouse. Data Warehouse Design Methodology: Entity Relationship Modeling and Dimensional Modeling. OLAP in data warehousing and different types of OLAP such as MOLAP, ROLAP and HOLAP. Indexing techniques used in data warehousing. Hardware and software systems consideration for data warehousing. Data warehouse maintenance.</p>	
<p><b>Reference Material:</b>                  1. Paulraj Ponniah, Data Warehousing Fundamentals, John Wiley &amp; Sons Inc., NY.                  2. W.H. Inmon, Building the Data Warehouse (Second Edition), John Wiley &amp; Sons Inc., NY.                  3. Ralph Kimball and Margy Ross, The Data Warehouse Toolkit (Second Edition), John Wiley &amp; Sons Inc., NY.</p>	

<b>Course Name: Financial Management</b>	
<b>Course Structure:</b> Lectures: 3 / Labs: 0	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> None	
<b>Course Outline:</b> Introduction to Financial Management, Concepts and Models in Valuation, The time value of money, Fundamentals of risk and portfolio analysis,	



Valuation of stocks and bonds, The capital Asset Pricing Model, the Arbitrage Pricing Model and other valuation models. The Cost of Capital: Capital structure and Dividend Policy, The cost of capital, Capital structure theory, Capital structure policy and optimal capital structure, Internal financing and dividends policy Capital Budgeting: The basis of capital budgeting, The determination and use of cash flow, Mutually exclusive investments and capital rationing, Annual equivalent cost and replacement decisions, Risk analysis and the optimal capital budget, Islamic guidelines for financial management: The rationale of prohibition of interest, Alternate capital structure, Capital Budgeting in an Interest free economy, working Capital Management in 100% equity capital structure.

**Reference Material:** *Financial Management* by Charles H. Gibson.

## Semester 6.

<b>Course Name: Multimedia Systems and Design</b>	
<b>Course Structure:</b> Lectures: 2, Lab: 3	<b>Credit Hours:</b> 3
<b>Prerequisites:</b> Fundamentals of Information Technology (required)	
<b>Objectives:</b> To introduce students to the complete process of multimedia system specification, design, testing, and prototyping, including the tools and techniques for integrating multimedia content (text, graphics, images, sound, animation, motion video and virtual reality) into a product, to present design principles and techniques to maximize the effectiveness of such products, and to give the students practice in the production using a variety of media and tools. Introduction to multimedia systems, multimedia applications and development tools.	
<b>Course Outline:</b> Introduction to multimedia systems, software, hardware, various equipment, video and audio capture, annotation, storage and playback techniques, multimedia software development tools, multimedia applications, step-by-step procedure in developing multimedia systems: (specification, design, testing, and prototyping), multimedia standards, Student projects - developing multimedia systems in the laboratory.	

**Suggested Text Books:**

1. [Multimedia: Making it Work, Seventh Edition](#) by Tay Vaughan (Paperback - Dec 20, 2006)
2. Shuman, James, Multimedia Concepts, Enhanced Edition, Cengage Learning, 2002
3. Lake, Susan and Karen Bean, Digital Multimedia: The Business of Technology, Cengage Learning, 2007

**Reference Material:**

1. Z. M. Li; M. S. Drew: Fundamentals of Multimedia. Prentice Hall 2004, ISBN: 0-13-127256-X
2. N. Chapman; J. Chapman: Digital Multimedia. (2nd ed.), Wiley 2004, ISBN: 0-470-85890-7
3. Villalobos, Ray, Exploring Multimedia for Designers, Cengage Learning, 2007.

<b>Course Name: Technology Management</b>	
<b>Course Structure:</b> Lectures: 3/Labs: 0	<b>Credit Hours: 3</b>
Prerequisites: None	
<b>Objectives:</b>	
(a) to introduce basic management functions, focusing on technology management issues,	
(b) case study to appraise students real problems	
<b>Course Outline:</b>	
Introduction and issues in technology management; Basic management functions (Planning, Control, Decision making, organizing etc.); Business Change and Technology challenges and issues; Technology strategy, goals and objectives, common hurdles; Technology transfer issues related to hardware, software, communications, human resources, etc.; IT as change enabling technology, assessment and selection of technology, training planning, equipment and systems acquisition processes; Implementation processes; Common challenges in change management; Small case study.	
<b>Reference Material:</b>	
1. Robins Stephan, "Management"	
2. Griffwn, "Principles of Management"	
3. Robert Williams and Marks Walla. "The Ultimate Window 2000 System Administration's Guide.	

<b>Course Name: Telecommunication Systems</b>	
<b>Course Structure:</b> Lectures:3 Labs: 0/3	<b>Credit Hours: ¾</b>
Prerequisites: None	
<b>Objectives:</b> To provide a first level exposure to the broad domain of	

## telecommunication Systems

**Course Outline:** Introduction to media, bandwidth and noise. Twisted pair (UTP, STP), coaxial cables (types and specifications), optical fibres (types and losses), Introduction to optical sources and detectors. Microwave links, satellite communication and infrared links. Frequency Division Multiplexing (FDM), TDM, FDMA, TDMA and CDMA. Switching: circuit and packet switching. Introduction to mobile and cellular communications. Block diagram and current trends.

**Reference Material:**

1. *Introduction to Telecommunications Network Engineering*, 2nd edition, T. Aattalinen, Artech House 2003, ISBN: 1580535003.
2. *Fundamentals of Telecommunication Networks*, T. Saadawi, Wiley US, ISBN: 0471515825.
3. *Telecommunication Systems*, P. G. Fonteolliet, Artech House 1991.

**Semester 7.****Course Name: System Programming**

**Course Structure:** Lectures: 2 / Labs: 3    **Credit Hours:** 3

**Prerequisites:** Operating Systems

**Objectives:** Demonstrate mastery of the internal operation of Unix system software including assemblers, loaders, macro-processors, interpreters, interprocess 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:**

1. *The UNIX Programming Environment*, B. Kernighan & R. Pike Prentice-Hall, 1984.
2. *System Software*, Leland L. Beck, Addison-Wesley Longmsan, 1990, ISBN: 0-201-50945-8.

**Course Name: Network Security**

**Course Structure:** Lectures: 3/Labs: 0    **Credit Hours:** 3    **Semester:** 7

**Prerequisites:** Computer Communication and Network

<b>Course Outline:</b> Principles and Practices of network security, security threats and methods to avoid them, authentication applications, electronic mail security, electronic transaction security and digital signatures, IP security, web security, system security, intruders and viruses, firewalls, introduction to cryptographic algorithms, standard security protocols, cyber crime, policy and regulations.
<b>Reference Material:</b> 1. Cryptography and Network Security: Principles and Practice, 4/E, William Stallings, Prentice Hall, 2005. 2. Government Policy documents on security issues.

<b>Course Name: System Integration and Architecture</b>		
<b>Course Structure:</b> Lectures: 3 / Labs: 0	<b>Credit Hours: 3</b>	
<b>Prerequisites:</b> Fundamentals of Information Technology (Required), Introduction to Software Development (Recommended)		
<b>Objectives:</b> This course will prepare the students to understand the system level requirements of an organization and acquire the required information and communication resources, integrate and deploy these resources in the form of a system.		
<b>Course Outline:</b> System level requirements gathering and analysis, acquisition, sourcing, integration, project management, testing and quality assurance, organizational context and architecture., intersystem's communication, data mapping and exchange, integrative coding, scripting techniques, software security and an overview of programming languages.		
<b>Suggested Text Books:</b> 1. Enterprise Integration: An Architecture for Enterprise Application and Systems Integration (Paperback), by <a href="#">Fred A. Cummins</a> (Author), Paperback: 496 pages, Publisher: Wiley; 1st edition (February 1, 2002), ISBN-10: 0471400106		

<b>Course Name: System and Network Administration</b>		
<b>Course Structure:</b> Lectures: 2/Labs: 1	<b>Credit Hours: 3</b>	<b>Semester: 5</b>
<b>Suggested Prerequisites:</b> Computer Communication and Networks, Operating Systems		

<p><b>Objectives:</b> This course will give an overview of systems and network administration based on both Windows and Linux environments. The objective are common system administration tasks and practices and how to implement and maintain standard services like email, file sharing, DNS and similar. The course is primarily dealing with the Linux and Windows operating systems and especially with Linux-based servers and Window-based clients, but some information about the most fundamental differences between various Linux systems will be provided. In labs focus is on how to install, setup and maintain Linux server machine and to perform various system administration and security related tasks on those machines.</p>
<p><b>Course Outline:</b> Brief introduction to the Networks, Homogenous and Heterogeneous networks, Issues involved in the setup of Heterogeneous networks, File systems, Configuration issues, Fundamentals of Linux user interface, Installation and administration of heterogeneous networks using Windows and Linux platforms. System installation, booting and halting the system, file systems and directory permission structures, print and disk quotas, device configuration and management, user account administration, security, client administration, disk maintenance, remote access, remote administration, the use of schedulers, the use of advanced scripting to ease system administration tasks, configuration management, template implementation and cross directory implementation.</p>
<p><b>Suggested Textbooks:</b></p>
<p><b>Reference Material:</b></p> <ol style="list-style-type: none"> <li>1. Practice of System and Network Administration, the 2<sup>nd</sup> Edition by Thomas A, Limoncelli, Hogan, 2005.</li> <li>2. Windows Administration Latest Edition, Microsoft Press</li> <li>3. Linux Administration Guide Latest Edition</li> </ol>

## Semester 8.

<b>Course Name: Human Resource Management</b>	
<b>Course Structure:</b> Lectures: 3 / Labs: 0	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> None	
<b>Course Outline:</b> An overview of Human Resource Management and Human Resource Manager. The Environment of Human Resource Management, external and Internal Environment. Equal Employment Opportunity and Affirmative Action. Job Analysis: A Basic Human Resource Tool. Human Resource Planning, Recruitment, and Selection. Organization Change and Human Resource Development. Corporate Culture and Organization Development. Career Planning Development. Performance Appraisal.	
<b>Reference Material:</b> <i>Managing Human Resource</i> by Wayne F. Cascio.	

## Outlines of Road Map BS(IT) 2012-16

**Semester 1.**

<b>Course Name: Programming Fundamentals</b>	
<b>Course Structure:</b> Lectures: 3, Labs: 1	<b>Credit Hours: 4</b>
<b>Prerequisites:</b> None	
<b>Objectives:</b> 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.	
<b>Course Outline:</b> Overview of computers and programming. Overview of language for e.g. C language C. Basics of structured and Modular programming. Basic 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.	
<b>Reference Material:</b>	
3. Problem Solving and Program Design in C / 6E Hanly & Koffman Addison-Wesley   Published: 02/06/2009 ISBN-10: 0321535421   ISBN-13: 9780321535429	
4. C How to Program, 5/E <b>(Harvey &amp; Paul) Deitel &amp; Deitel</b> , ISBN-10: 0132404168 ISBN-13: 9780132404167 Publisher: Prentice Hall Copyright: 2007	

<b>Course Name: Introduction to Information and Communication Technologies</b>	
<b>Course Structure:</b> Lectures: 2 / Labs: 3	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> None (first semester course)	
<b>Objectives:</b>	
This course focuses on a breadth-first coverage of the use of computing and communication technologies to solve real life problems; including computing environments, general application software like word processing, visual presentation applications, tabular data manipulation, DBMS, WWW, Email management systems, Virus, Anti-Virus and Spam Protection; Introduction to the basic computing hardware (main building blocks), operating systems, data networks; software engineering and communication technology along with social and ethical issues. An introduction of the program of study in computing for which this course is being taught (CS, IT, SE etc.). The course attempts to provide every student a set of productivity tools that they will be able to use for the rest of their lives.	

<p><b>Course Outline:</b>                  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 Communication Technology, Operating system, Compiler, DBMS, Computer networks and internet, WWW, web mail applications, Computer graphics, AI, Viruses and Anti-Viruses, Use of office productivity tools, such as word processors, spreadsheets, presentation applications, etc., Social, Ethical, Professional and Legal Issues, and overview of the complete program of studies in computing and its structure.</p>
<p><b>Suggested Text Book:</b>                  2. Introduction to Computers by Peter Norton, 6th Edition, McGraw-Hill SiE, ISBN 0-07-059374-4.</p> <p><b>Reference Material:</b>                  6. Computers: Information Technology in Perspective, 9/e by Larry Long and Nancy Long, Prentice Hall, 2002/ISBN: 0130929891.                  7. An Invitation to Computer Science, Schneider and Gersting, Brooks/Cole Thomson Learning, 2000.                  8. Information System Today by Leonard Jessup, Joseph Valacich.                  9. Computers Today by Suresh K. Basandra.                  10. Computer Science: An overview of Computer Science, Sherer.</p>

<b>Course Name: English-I (Functional English)</b>	
<b>Course Structure:</b> Lectures: 3 / Labs: 0	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> None	
<b>Objectives:</b> To develop good English writing, language usage and reading skills.	
<b>Course Outline:</b> 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.	
<b>Reference Material:</b> <i>Warriner's English Grammar and Composition</i> , John E. Warriner	

<b>Course Name: Islamic &amp; Pakistan Studies</b>	
<b>Course Structure:</b> Lectures: 3 / Labs: 0	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> None	
<b>Objectives:</b> 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	
<b>Course Outline:</b> Fundamentals of Islam. (Aqid, 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.	
<b>Reference Material:</b> <i>Chaudary M. Ali, The Emergence of Pakistan, 1967.</i> <i>K.K.Aziz, The making of Pakistan, 1976.</i>	

<b>Course Name: Calculus and Analytic Geometry</b>	
<b>Course Structure:</b> Lectures: 3, Labs: 0	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> None	
<b>Objectives:</b> To provide foundation and basic ground for calculus and analytical geometry background.	
<b>Course Outline:</b> 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.	
<b>Reference Material:</b> 6. <i>Swokowski, Olinick and Pence, Calculus and Analytical Geometry, 6<sup>th</sup> edition, 1994, Brooks/Cole Publishers.</i> 7. <i>Howard Anton, Calculus, 7<sup>th</sup> edition. 2002, John Wiley and Sons (WIE).</i> 8. William E. Boyce Richard C. Diprima, <i>Calculus</i> , John Wiley & Sons, ISBN:	



0471093335.

9. Thomas Finny, Calculus and Analytical Geometry, 10th edition, John Wiley and Sons.
10. Erwin Kreyzig, Advanced Engineering Mathematics, 7th edition, 1993, John Wiley & Sons Inc.

**Semester 2.**

<b>Course Name: Object Oriented Programming</b>	
<b>Course Structure:</b> Lectures: 2, Labs: 1	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> Programming Fundamentals	
<b>Objectives:</b> The course aims to focus on object-oriented concepts, analysis and software development.	
<b>Course Outline:</b> Evolution of Object Oriented (OO) programming, OO concepts and principles, problem solving in OO paradigm, OO program 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	
<b>Reference Material:</b>	
3. C++ How to Program, 6/E <b>(Harvey &amp; Paul) Deitel &amp; Deitel</b> ISBN-10: 0136152503 ISBN-13: 9780136152507 Publisher: Prentice Hall	
4. Java How to Program, 7/E <b>(Harvey &amp; Paul) Deitel &amp; Deitel</b> ISBN-10: 0132222205 ISBN-13: 9780132222204 Publisher: Prentice Hall	

<b>Course Name: Discrete Structures</b>	
<b>Course Structure:</b> Lectures: 3 / Labs: 0	<b>Credit Hours: 3</b>
<b>Prerequisites: None</b>	
<b>Objectives:</b> 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. In this course more emphasis shall be given to statistical and probabilistic formulation with respect to computing aspects.	
<b>Course Outline:</b> Introduction to logic and proofs: Direct proofs; proof by contradiction, Sets, Combinatorics, Sequences, Formal logic, Propositional and predicate calculus, Methods of Proof, Mathematical Induction and Recursion, loop invariants, Relations and functions, Pigeonhole principle, Trees and Graphs, Elementary number theory, Optimization and matching. Fundamental structures: Functions; relations (more specifically recursions); pigeonhole principle; cardinality and countability, probabilistic methods.	
<b>Reference Material:</b>	
1. Kenneth H. Rosen, <i>Discrete Mathematics and Its Applications</i> , 6TH edition, 2006, Mcgraw Hill Book Co.	
<b>Course Name: English-II (Technical and Report Writing)</b>	
<b>Course Structure:</b> Lectures: 3 / Labs: 0	<b>Credit Hours: 3</b>
<b>Prerequisites: None</b>	

<p><b>Objectives:</b> To develop efficient literature survey, analysis, report writing and document designing skills.</p>
<p><b>Course Outline:</b> 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.</p>
<p><b>Reference Material:</b> Greenfield, T., Research Methods, Guidance for Postgraduates, Arnold, 1996, 034064629.</p>

<p><b>Course Name: Probability and Statistics</b></p>	
<p><b>Course Structure:</b> Lectures: 3, Labs: 0</p>	<p><b>Credit Hours: 3</b></p>
<p><b>Prerequisites:</b> None</p>	
<p><b>Objectives:</b> To introduce the concepts of data analysis, presentation, counting techniques, probability and decision making</p>	
<p><b>Course Outline:</b> Introduction to Statistics, Descriptive Statistics, Statistics in decision making, Graphical representation of Data Stem-and Lead plot, Box-Cox plots, measures of central tendencies and dispersion, moments of frequency distribution; Counting techniques, introduction to probability, sample space, events, laws of probability, Conditional probability and Baye's theorem with application to random variable (Discrete and continuous) Binomial, Poisson, Geometric, Negative Binomial Distributions; Exponential Gamma and Normal distributions. Regression and Correlation, Estimation and testing of hypotheses, use of elementary statistical packages for explanatory Data analysis.</p>	
<p><b>Reference Material:</b></p> <ol style="list-style-type: none"> <li>4. Ronald Walpole, Myers, Myers, Ye, "Probability &amp; Statistics for Engineers &amp; Scientists", 8<sup>th</sup> edition, 2008, <b>Prentice Hall</b> Publisher.</li> <li>5. Lay L. Devore, Probability and Statistics for Engineering and the Sciences, 2003, Duxbury Publishers.</li> <li>6. G. Cowan, <i>Statistical Data Analysis</i>, 1998, Clarendon, Oxford.</li> </ol>	

<b>Course Name: Fundamentals of Information Technology</b>	
<b>Course Structure:</b> Lectures: 3	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> Introduction to Computing (recommended)	
<b>Objectives:</b> To introduce students to the scope of the field of Information Technology, to give them a basic understanding of information, its organization, transmission, storage, retrieval and presentation, and to explore some of the computer based technologies used for these purposes.	
<b>Course Outline:</b> Introduction to the academic discipline of IT as well as the general meaning of IT as per objectives given in the start of this program. Definitions of information, information technology as the use of computer based technology to organize, store, retrieve, transmit and present information, sender/receiver/channel model for information transfer. Information organization via databases, data modeling, and information management systems. Basic network ideas and models. Differences in human and machine processing of information, information transfer at the human/machine interface, modalities for information presentation, advantages and disadvantages of various presentation media. Challenging issues for today's information and communication technologies, issues in organizational need assessment and management of large scale information systems, along with social, legal and ethical issues related with each topic.	
<b>Suggested Text Book:</b> 3. Cyganski, David, John A. Orr and Richard F. Vaz, Information Technology Inside and Outside, Pearson Education (LPE), 2001 4. Information Technology: Principles, Practices, and Opportunities (3rd Edition) (Hardcover), by <a href="#">James A. Senn</a> (Author), Prentice Hall; 3 edition (December 1, 2003), ISBN-10: 0131436260	
<b>Reference Material:</b> 6. Cyganski, David, John A. Orr and Richard F. Vaz, Information Technology Inside and Outside, Pearson Education (LPE), 2001 7. Ray, Ajoy Kumar and Tinku Acharya, Information Technology: Principles and Applications, Prentice-Hall India, 2004 8. Information Technology: Principles, Practices, and Opportunities (3rd Edition) (Hardcover), by <a href="#">James A. Senn</a> (Author), Prentice Hall; 3 edition (December 1, 2003), ISBN-10: 0131436260 9. Introduction to Information Technology (Hardcover), by <a href="#">Efraim Turban</a> (Author), <a href="#">Rex Kelly Rainer</a> (Author), <a href="#">Richard E. Potter</a> (Author), Hardcover: 592 pages, Publisher: 10. Wiley; 2 edition (July 12, 2002), ISBN-10: 0471073806	

Basic Electronics

**Semester 3.**

## Data Structure and Algorithms

<b>Course Name: Digital Logic And Design</b>	
<b>Course Structure:</b> Lectures: 2 / Labs: 3	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> Discrete Structures, Introduction to Computing	
<b>Objectives:</b> 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.	
<b>Course Outline:</b> 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, subtractors, 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 Machine (ASM) Charts, Asynchronous circuits, Memory systems, Functional organization, Multiprocessor and alternative architectures: Introduction to SIMD, MIMD, VLIW, EPIC; systolic architecture; interconnection networks; shared memory systems; cache coherence; memory models and memory consistency, Performance enhancements, Contemporary architectures.	
<b>Reference Material:</b> <i>Digital Design, 2nd Ed., M. Morris Mano, Prentice Hall, 1991.</i> <i>Practical Digital Logic Design and Testing, P K Lala, Prentice Hall, 1996.</i>	

<b>Course Name: Digital Logic And Design</b>	
<b>Course Structure:</b> Lectures: 2 / Labs: 3	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> Discrete Structures, Introduction to Computing	
<b>Objectives:</b> 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.	
<b>Course Outline:</b> 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, subtractors, 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 Machine (ASM) Charts, Asynchronous circuits, Memory systems, Functional organization, Multiprocessor and alternative	

architectures: Introduction to SIMD, MIMD, VLIW, EPIC; systolic architecture; interconnection networks; shared memory systems; cache coherence; memory models and memory consistency, Performance enhancements, Contemporary architectures.

**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: Communication Skills English III**

**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 nonverbal 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.

**Course Name: Introduction to Database Systems**

**Course Structure:** Lectures: 2/Labs: 3 | **Credit Hours: 3**

**Prerequisites:** Data Structures and Algorithms

**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

<p><b>Course Outline:</b>                  Basic database concepts; Logical database Modelling and design: Entity Relationship diagram (ERD), Enhanced ERD Relational data model: mapping ERD to relational model, Functional dependencies and Normalization: 1st -3rd Normal Form and BCNF, Relational Algebra; Structured Query language (SQL); Fundamental knowledge about Transaction processing, concurrency control recovery techniques and query optimization concepts.</p>
<p><b>Reference Material:</b>                  5. C. J. Date, Database Systems, Addison Wesley Pub. Co.                  6. R. Elmasri and S. Navathe. Fundamentals of Database Systems, Benjamin/Cummings.                  7. Abraham Silberschatz, Henry F. Korth S. Sudarshan. "Database System Concepts".                  8. T.Connolly and C.Begg . "Database Systems, a Practical Approach to Design, Implementation and Management", Pearson education,.</p>

Sociology

**Semester 4.**

<b>Course Name: Operating Systems</b>	
<b>Course Structure:</b> Lectures: 3, Labs: 1	<b>Credit Hours: 4</b>
<b>Prerequisites:</b> None	
<p><b>Objectives:</b> To help students gain a general understanding of the principles and concepts governing the functions of operating systems and acquaint students with the layered approach that makes design, implementation and operation of the complex OS possible.</p>	
<p><b>Course Outline:</b> 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.</p> <p>Lab assignments involving different single and multithreaded OS algorithms.</p>	
<p><b>Reference Material:</b>                  3. <i>Applied Operating Systems Concepts</i>, 7<sup>th</sup> Edition, Silberschatz A., Peterson, J.L., &amp; Galvin P.C. 2004.                  4. <i>Modern Operating Systems</i>, 3rd Edition, Tanenmaum A.S., 2008.</p>	

<b>Course Name: Computer Organization and Assembly Language</b>	
<b>Course Structure:</b> Lectures: 2, Labs: 1	<b>Credit Hours: 3</b>

<b>Prerequisites:</b> Digital Logic Design
<b>Objectives:</b> 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.
<b>Course Outline:</b> Microprocessor Bus Structure: Addressing, Data and Control, Memory Organization and Structure (Segmented and Linear Models), 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. Objectives and Perspectives of Assembly Language, Addressing Modes, Introduction to the Assembler and Debugger, Manipulate and translate machine and assembly code, Describe actions inside the processing chip, Discuss operations performed by an instruction set, Write a fully documented program, Using an assembler of choice.
<b>Reference Material:</b> 4. Stallings, "Computer Organization & Architecture", 7 <sup>th</sup> ed, Prentice HALL, 2006. 5. Irvine, Assembly Language for Intel-based Computers, 5th ed, Prentice Hall, 2007. 6. Computer Organization and Design, The Hardware/Software Interface, 4th ed, by David A. Patterson and John L. Hennessy, 2008. Elsevier Publishers.

<b>Course Name: Computer Graphics</b>
<b>Course Structure:</b> Lectures: 2 / Labs: 3   <b>Credit Hours:</b> 3
<b>Prerequisites:</b> Object Oriented Programming , Visual Programming
<b>Objectives:</b> Study of various algorithms in computer graphics and their implementation in any programming language.
<b>Course Outline:</b> Graphics hardware. Fundamental algorithms. Applications of graphics. Interactive graphics programming — graph plotting, windows and clipping, and segmentation. Programming raster display systems, Differential Line Algorithm, panning and zooming. Raster algorithms and software — Scan-Converting lines, characters and circles. Scaling, Rotation, Translation, Region filling and clipping. Two and three dimensional imaging geometry (Perspective projection and Orthogonal projection) and transformations. Curve and surface design, rendering, shading, colour and animation.
<b>Reference Material:</b> 3. 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. 4. <i>Computer Graphics</i> , F.S.Hill, Maxwell MacMillan ISBN: 0-02-354860-6. 3. Interactive Computer Graphics: Functional, Procedural and Device-level methods; Peter Burger and Duncan. F. Gillies; Addison-Wesley, (2003)

<b>Course Name: Computational Linear Algebra</b>	
<b>Course Structure:</b> Lectures: 2 / Labs: 1	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> Linear Algebra, Calculus	
<p><b>Objectives:</b> Students will gain familiarity with and facility in the use of standard techniques for the numerical solution of a variety of problems in linear algebra, including solutions of linear systems, various matrix operations, evaluation of determinants and permanents, calculation of eigenvalues and determination of eigenvectors. Students will be introduced to various discrete transforms and apply some specific transforms to the solution of simple problems. In all cases, students will be introduced to possible sources of error and techniques for estimating the magnitude.</p>	
<p><b>Course Outline:</b> Background matrix algebra, measuring vectors, matrices, subspaces, and linear system sensitivity, numerical matrix algebra, Gaussian elimination, special linear systems, orthogonalization and least squares methods, the unsymmetrical eigenvalues problem, the symmetric eigenvalues problem, Lanczos methods, iterative methods for linear systems, functions of matrices. Introduction of discrete transforms, discrete Fourier and cosine transforms and simple applications. Error analysis and estimation for all techniques studied.</p> <p><i>Sample labs and assignments:</i></p> <ul style="list-style-type: none"> <li>- Implementation and testing of algorithms for typical linear algebra problems, including an analysis of errors.</li> </ul>	
<p><b>Resources:</b></p> <ol style="list-style-type: none"> <li>1. Golub, G., and C. Van Loan, <i>Matrix Computations (3/e)</i>, 1996</li> <li>2. Sewell, G., <i>Computational Methods of Linear Algebra (2/e)</i>, 2005</li> <li>3. Nievergelt, Y., <i>Wavelets Made Easy</i>, 1999.</li> </ol>	

Economics  
Organizational Behavior



## Semester 5.

### Introduction to Software Development

<b>Course Name: Web Systems and Technologies</b>	
<b>Course Structure:</b> Lectures: 3	<b>Credit Hours:</b> 3
<b>Prerequisites:</b> Fundamentals of Information Technology (required)	
<b>Objectives:</b> 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.	
<b>Course Outline:</b> In-depth study of World Wide Web architectures, protocols and standards (HTTP, HTML, XHTML, CGI, XML, WML, cHTML, etc.), Web Technologies and Tools (such as scripting tools) for web application development and deployment (web servers, application servers, etc.), Web Based Applications including search engines and content management, management of large scale web based information systems, Web Services, Web2, Semantic Web, and Web3, principles of web site design, practical exercise in web site development.	

**Suggested Text Books:**

3. Nuckles, Craig, Web Applications: Concepts and Real World Design, Wiley 2006
4. Programming the World Wide Web (4th Edition) (Paperback), by [Robert W. Sebesta](#) (Author), Paperback: 752 pages, Publisher: Addison Wesley; 4th edition (August 17, 2007), ISBN-10: 0321489691

**Reference Material:**

9. Gosselin, Dan, et. al., The Web Warrior Guide to Web Design Technologies, Cengage Learning, 2003
10. Zak, Diane, et. al., The Web Warrior Guide to Web Programming, Cengage Learning, 2003
11. Leasure, T., Bob Leasure and James Leasure, The Web Warrior Guide to Web Database Technologies, Cengage Learning, 2003
12. Morrison, Mike and Joline Morrison, Database Driven Websites, 2/e, Cengage Learning, 2002
13. Web Wizard series for various technologies, Addison-Wesley
14. Jackson, J. C., Web Technologies: A Computer Science Perspective, Pearson (LPE), 2008
15. [Web Application Architecture: Principles, Protocols and Practices](#) by Leon Shklar and Richard Rosen (Paperback - Oct 31, 2008), Paperback: 420 pages, Publisher: Wiley; 2 edition (October 31, 2008), ISBN-10: 047051860X
16. [Web Engineering: The Discipline of Systematic Development of Web Applications](#) by Gerti Kappel, Birgit Prýýll, Siegfried Reich, and Werner Retschitzegger (Paperback - Jul 5, 2006)

**Course Name: Information Systems**

**Course Structure:** Lectures: 3/Labs: 0

**Credit Hours: 3**

**Prerequisites:** None

**Objectives:**

Major emphasis than is usual for Information Systems analysis, design, and success and management aspects will be placed in order to discuss the management of the technical processes involved. Actual Case Studies will be central to the delivery of the unit. Recent, well-accepted, developments in all aspects of Information Systems development will also be covered and discussed. This course will facilitate students to understand the advanced concepts of information systems.

<p><b>Course Outline:</b>                  Introduction and Classification of Information Systems, Lifecycle of IS Projects, Major Taxonomies of Information Systems, IS Strategies, Types of IS Strategies, Business Strategies and Types, Alignment of both Strategies, Information Systems success and Failure, Critical Success Factors, Information Systems Project Evaluation, IS Feasibility Study and Types, Managing Information Systems Projects, Structure of IS Projects, Managing Conflicts in Information Systems projects, Role of CIO, System Analysis of IS Projects, Design Issues in IS, Coupling, Cohesion and Structured Charts, Team Composition, Detailed IS Design Issues, Advanced Design Issues, Measuring Project Complexity, Prototype Approaches, CASE Tools, Soft System Methods (SSM), Rapid Application Development (RAD), Case Studies.</p>
<p><b>Reference Material:</b>                  2. Enterprise Information Systems, O'Brien and Marakas, 13th Edition, McGraw-Hill, 2007</p>

<p><b>Course Name: Data Warehousing</b></p>
<p><b>Course Structure:</b> Lectures: 2/Labs: 3      <b>Credit Hours: 3</b></p>
<p><b>Prerequisites:</b> Introduction to Database Systems</p>
<p><b>Objectives:</b>                  (a) to manage large database systems,                  (b) to monitor the processing of database system.</p>
<p><b>Course Outline:</b>                  Introduction of the business context for data warehousing and decision support systems. Differences between TPS and DSS environments. Data warehouse Architecture. Data Marts. Differentiate Data Marts and Data Warehouse. Evaluation of Data Warehouse. Data Warehouse Design Methodology: Entity Relationship Modeling and Dimensional Modeling. OLAP in data warehousing and different types of OLAP such as MOLAP, ROLAP and HOLAP. Indexing techniques used in data warehousing. Hardware and software systems consideration for data warehousing. Data warehouse maintenance.</p>
<p><b>Reference Material:</b>                  4. Paulraj Ponniah, Data Warehousing Fundamentals, John Wiley &amp; Sons Inc., NY.                  5. W.H. Inmon, Building the Data Warehouse (Second Edition), John Wiley &amp; Sons Inc., NY.                  6. Ralph Kimball and Margy Ross, The Data Warehouse Toolkit (Second Edition), John Wiley &amp; Sons Inc., NY.</p>

Visual Programming

<p><b>Course Name: Financial Management</b></p>
<p><b>Course Structure:</b> Lectures: 3 / Labs: 0      <b>Credit Hours: 3</b></p>
<p><b>Prerequisites:</b> None</p>
<p><b>Course Outline:</b> Introduction to Financial Management, Concepts and Models in</p>

Valuation, The time value of money, Fundamentals of risk and portfolio analysis, Valuation of stocks and bonds, The capital Asset Pricing Model, the Arbitrage Pricing Model and other valuation models. The Cost of Capital: Capital structure and Dividend Policy, The cost of capital, Capital structure theory, Capital structure policy and optimal capital structure, Internal financing and dividends policy Capital Budgeting: The basis of capital budgeting, The determination and use of cash flow, Mutually exclusive investments and capital rationing, Annual equivalent cost and replacement decisions, Risk analysis and the optimal capital budget, Islamic guidelines for financial management: The rationale of prohibition of interest, Alternate capital structure, Capital Budgeting in an Interest free economy, working Capital Management in 100% equity capital structure.

**Reference Material:** *Financial Management* by Charles H. Gibson.

## Semester 6.

Computer Communications and Networks

<b>Course Name: Multimedia Systems and Design</b>	
<b>Course Structure:</b> Lectures: 2, Lab: 3	<b>Credit Hours:</b> 3
<b>Prerequisites:</b> Fundamentals of Information Technology (required)	
<b>Objectives:</b> To introduce students to the complete process of multimedia system specification, design, testing, and prototyping, including the tools and techniques for integrating multimedia content (text, graphics, images, sound, animation, motion video and virtual reality) into a product, to present design principles and techniques to maximize the effectiveness of such products, and to give the students practice in the production using a variety of media and tools. Introduction to multimedia systems, multimedia applications and development tools.	
<b>Course Outline:</b> Introduction to multimedia systems, software, hardware, various equipment, video and audio capture, annotation, storage and playback techniques, multimedia software development tools, multimedia applications, step-by-step procedure in developing multimedia systems: (specification, design, testing, and prototyping), multimedia standards, Student projects - developing multimedia systems in the laboratory.	

**Suggested Text Books:**

4. [Multimedia: Making it Work, Seventh Edition](#) by Tay Vaughan (Paperback - Dec 20, 2006)
5. Shuman, James, Multimedia Concepts, Enhanced Edition, Cengage Learning, 2002
6. Lake, Susan and Karen Bean, Digital Multimedia: The Business of Technology, Cengage Learning, 2007

**Reference Material:**

4. Z. M. Li; M. S. Drew: Fundamentals of Multimedia. Prentice Hall 2004, ISBN: 0-13-127256-X
5. N. Chapman; J. Chapman: Digital Multimedia. (2nd ed.), Wiley 2004, ISBN: 0-470-85890-7
6. Villalobos, Ray, Exploring Multimedia for Designers, Cengage Learning, 2007.

<b>Course Name: Technology Management</b>	
<b>Course Structure:</b> Lectures: 3/Labs: 0	<b>Credit Hours: 3</b>
Prerequisites: None	
<b>Objectives:</b>	
(a) to introduce basic management functions, focusing on technology management issues,	
(b) case study to appraise students real problems	
<b>Course Outline:</b>	
Introduction and issues in technology management; Basic management functions (Planning, Control, Decision making, organizing etc.); Business Change and Technology challenges and issues; Technology strategy, goals and objectives, common hurdles; Technology transfer issues related to hardware, software, communications, human resources, etc.; IT as change enabling technology, assessment and selection of technology, training planning, equipment and systems acquisition processes; Implementation processes; Common challenges in change management; Small case study.	
<b>Reference Material:</b>	
4. Robins Stephan, "Management"	
5. Griffwn, "Principles of Management"	
6. Robert Williams and Marks Walla. "The Ultimate Window 2000 System Administration's Guide.	

<b>Course Name: Telecommunication Systems</b>	
<b>Course Structure:</b> Lectures:3 Labs: 0/3	<b>Credit Hours:</b> ¾
<b>Prerequisites:</b> None	
<b>Objectives:</b> To provide a first level exposure to the broad domain of telecommunication Systems	
<b>Course Outline:</b> Introduction to media, bandwidth and noise. Twisted pair (UTP, STP), coaxial cables (types and specifications), optical fibres (types and losses), Introduction to optical sources and detectors. Microwave links, satellite communication and infrared links. Frequency Division Multiplexing (FDM), TDM, FDMA, TDMA and CDMA. Switching: circuit and packet switching. Introduction to mobile and cellular communications. Block diagram and current trends.	
<b>Reference Material:</b>	
4. <i>Introduction to Telecommunications Network Engineering</i> , 2nd edition, T. Aattalainen, Artech House 2003, ISBN: 1580535003.	
5. <i>Fundamentals of Telecommunication Networks</i> , T. Saadawi, Wiley US, ISBN: 0471515825.	
6. <i>Telecommunication Systems</i> , P. G. Fonteolliet, Artech House 1991.	

Knowledge Based Systems

Marketing

## Semester 7.

Human Computer Interaction

<b>Course Name: System Programming</b>	
<b>Course Structure:</b> Lectures: 2 / Labs: 3	<b>Credit Hours:</b> 3
<b>Prerequisites:</b> Operating Systems	
<b>Objectives:</b> Demonstrate mastery of the internal operation of Unix system software including assemblers, loaders, macro-processors, interpreters, interprocess communication.	
<b>Course Outline:</b> 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.	
<b>Reference Material:</b>	
1. <i>The UNIX Programming Environment</i> , B. Kernighan & R. Pike Prentice-Hall, 1984.	
2. <i>System Software</i> , Leland L. Beck, Addison-Wesley Longmsan, 1990, ISBN: 0-201-50945-8.	

<b>Course Name: Network Security</b>		
<b>Course Structure:</b> Lectures: 3/Labs: 0	<b>Credit Hours:</b> 3	<b>Semester:</b> 7
<b>Prerequisites:</b> Computer Communication and Network		
<b>Course Outline:</b> Principles and Practices of network security, security threats and methods to avoid them, authentication applications, electronic mail security, electronic transaction security and digital signatures, IP security, web security, system security, intruders and viruses, firewalls, introduction to cryptographic algorithms, standard security protocols, cyber crime, policy and regulations.		
<b>Reference Material:</b> 3. Cryptography and Network Security: Principles and Practice, 4/E, William Stallings, Prentice Hall, 2005. 4. Government Policy documents on security issues.		

<b>Course Name: System Integration and Architecture</b>		
<b>Course Structure:</b> Lectures: 3 / Labs: 0	<b>Credit Hours:</b> 3	
<b>Prerequisites:</b> Fundamentals of Information Technology (Required), Introduction to Software Development (Recommended)		
<b>Objectives:</b> This course will prepare the students to understand the system level requirements of an organization and acquire the required information and communication resources, integrate and deploy these resources in the form of a system.		
<b>Course Outline:</b> System level requirements gathering and analysis, acquisition, sourcing, integration, project management, testing and quality assurance, organizational context and architecture., intersystem's communication, data mapping and exchange, integrative coding, scripting techniques, software security and an overview of programming languages.		
<b>Suggested Text Books:</b> 2. Enterprise Integration: An Architecture for Enterprise Application and Systems Integration (Paperback), by <a href="#">Fred A. Cummins</a> (Author), Paperback: 496 pages, Publisher: Wiley; 1st edition (February 1, 2002), ISBN-10: 0471400106		

<b>Course Name: System and Network Administration</b>		
<b>Course Structure:</b> Lectures: 2/Labs: 1	<b>Credit Hours: 3</b>	<b>Semester: 5</b>
<b>Suggested Prerequisites:</b> Computer Communication and Networks, Operating Systems		
<p><b>Objectives:</b>                  This course will give an overview of systems and network administration based on both Windows and Linux environments. The objective are common system administration tasks and practices and how to implement and maintain standard services like email, file sharing, DNS and similar. The course is primarily dealing with the Linux and Windows operating systems and especially with Linux-based servers and Window-based clients, but some information about the most fundamental differences between various Linux systems will be provided. In labs focus is on how to install, setup and maintain Linux server machine and to perform various system administration and security related tasks on those machines.</p>		
<p><b>Course Outline:</b>                  Brief introduction to the Networks, Homogenous and Heterogeneous networks, Issues involved in the setup of Heterogeneous networks, File systems, Configuration issues, Fundamentals of Linux user interface, Installation and administration of heterogeneous networks using Windows and Linux platforms. System installation, booting and halting the system, file systems and directory permission structures, print and disk quotas, device configuration and management, user account administration, security, client administration, disk maintenance, remote access, remote administration, the use of schedulers, the use of advanced scripting to ease system administration tasks, configuration management, template implementation and cross directory implementation.</p>		
<b>Suggested Textbooks:</b>		
<p><b>Reference Material:</b></p> <ol style="list-style-type: none"> <li>4. Practice of System and Network Administration, the 2<sup>nd</sup> Edition by Thomas A, Limoncelli, Hogan, 2005.</li> <li>5. Windows Administration Latest Edition, Microsoft Press</li> <li>6. Linux Administration Guide Latest Edition</li> </ol>		



## Smester 8:

IT Capstone

Professional Practices

<b>Course Name: Human Resource Management</b>	
<b>Course Structure:</b> Lectures: 3 / Labs: 0	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> None	
<b>Course Outline:</b> An overview of Human Resource Management and Human Resource Manager. The Environment of Human Resource Management, external and Internal Environment. Equal Employment Opportunity and Affirmative Action. Job Analysis: A Basic Human Resource Tool. Human Resource Planning, Recruitment, and Selection. Organization Change and Human Resource Development. Corporate Culture and Organization Development. Career Planning Development. Performance Appraisal.	
<b>Reference Material:</b> <i>Managing Human Resource</i> by Wayne F. Cascio.	

## Outlines Of Road Map BS (IT) 2013-17

### Semester 1.

<b>Course Name: Programming Fundamentals</b>	
<b>Course Structure:</b> Lectures: 3, Labs: 1	<b>Credit Hours: 4</b>
<b>Prerequisites:</b> None	
<b>Objectives:</b> 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.	
<b>Course Outline:</b> Overview of computers and programming. Overview of language for e.g. C language C. Basics of structured and Modular programming. Basic 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.	
<b>Reference Material:</b>	
5. Problem Solving and Program Design in C / 6E Hanly & Koffman Addison-Wesley   Published: 02/06/2009 ISBN-10: 0321535421   ISBN-13: 9780321535429	
6. C How to Program, 5/E <b>(Harvey &amp; Paul) Deitel &amp; Deitel</b> , ISBN-10: 0132404168 ISBN-13: 9780132404167 Publisher: Prentice Hall Copyright: 2007	

<b>Course Name: Introduction to Information and Communication Technologies</b>	
<b>Course Structure:</b> Lectures: 2 / Labs: 3	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> None (first semester course)	
<b>Objectives:</b> This course focuses on a breadth-first coverage of the use of computing and communication technologies to solve real life problems; including computing environments, general application software like word processing, visual presentation applications, tabular data manipulation, DBMS, WWW, Email management systems, Virus, Anti-Virus and Spam Protection; Introduction to the basic computing hardware (main building blocks), operating systems, data networks; software engineering and communication technology along with social and ethical issues. An introduction of the program of study in computing for which this course is being taught (CS, IT, SE etc.). The course attempts to provide every student a set of productivity tools that they will be able to use for the rest of their lives.	
<b>Course Outline:</b> 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 Communication Technology, Operating system, Compiler, DBMS, Computer networks and internet, WWW, web mail applications, Computer graphics, AI, Viruses and Anti-Viruses, Use of office productivity tools, such as word processors, spreadsheets, presentation applications, etc., Social, Ethical, Professional and Legal Issues, and overview of the complete program of studies in computing and its structure.	
<b>Suggested Text Book:</b> 3. Introduction to Computers by Peter Norton, 6th Edition, McGraw-Hill SiE, ISBN 0-07-059374-4.	
<b>Reference Material:</b> 11. Computers: Information Technology in Perspective, 9/e by Larry Long and Nancy Long, Prentice Hall, 2002/ISBN: 0130929891. 12. An Invitation to Computer Science, Schneider and Gersting, Brooks/Cole Thomson Learning, 2000. 13. Information System Today by Leonard Jessup, Joseph Valacich. 14. Computers Today by Suresh K. Basandra. 15. Computer Science: An overview of Computer Science, Sherer.	

<b>Course Name: English-I (Functional English)</b>	
<b>Course Structure:</b> Lectures: 3 / Labs: 0	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> None	
<b>Objectives:</b> To develop good English writing, language usage and reading skills.	
<b>Course Outline:</b> 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: Islamic & Pakistan Studies**

**Course Structure:** Lectures: 3 / Labs: 0 | **Credit Hours:** 3

**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: Calculus and Analytic Geometry**

**Course Structure:** Lectures: 3, Labs: 0 | **Credit Hours:** 3

**Prerequisites:** None

**Objectives:** To provide foundation and basic ground for 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:**

11. Swokowski, Olinick and Pence, *Calculus and Analytical Geometry*, 6<sup>th</sup> edition, 1994, Brooks/Cole Publishers.
12. Howard Anton, *Calculus*, 7<sup>th</sup> edition. 2002, John Wiley and Sons (WIE).
13. William E. Boyce Richard C. Diprima, *Calculus*, John Wiley & Sons, ISBN: 0471093335.
14. Thomas Finny, *Calculus and Analytical Geometry*, 10th edition, John Wiley and Sons.
15. Erwin Kreyzig, *Advanced Engineering Mathematics*, 7th edition, 1993, John Wiley & Sons Inc.

**Semester 2.**

<b>Course Name: Object Oriented Programming</b>	
<b>Course Structure:</b> Lectures: 2, Labs: 1	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> Programming Fundamentals	
<b>Objectives:</b> The course aims to focus on object-oriented concepts, analysis and software development.	
<b>Course Outline:</b> Evolution of Object Oriented (OO) programming, OO concepts and principles, problem solving in OO paradigm, OO program 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	
<b>Reference Material:</b>	
5. C++ How to Program, 6/E <b>(Harvey &amp; Paul) Deitel &amp; Deitel</b> ISBN-10: 0136152503 ISBN-13: 9780136152507 Publisher: Prentice Hall	
6. Java How to Program, 7/E <b>(Harvey &amp; Paul) Deitel &amp; Deitel</b> ISBN-10: 0132222205 ISBN-13: 9780132222204 Publisher: Prentice Hall	

<b>Course Name: Discrete Structures</b>	
<b>Course Structure:</b> Lectures: 3 / Labs: 0	<b>Credit Hours: 3</b>
<b>Prerequisites: None</b>	
<b>Objectives:</b> 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. In this course more emphasis shall be given to statistical and probabilistic formulation with respect to computing aspects.	
<b>Course Outline:</b> Introduction to logic and proofs: Direct proofs; proof by contradiction, Sets, Combinatorics, Sequences, Formal logic, Propositional and predicate calculus, Methods of Proof, Mathematical Induction and Recursion, loop invariants, Relations and functions, Pigeonhole principle, Trees and Graphs, Elementary number theory, Optimization and matching. Fundamental structures: Functions; relations (more specifically recursions); pigeonhole principle; cardinality and countability, probabilistic methods.	
<b>Reference Material:</b>	

1. Kenneth H. Rosen, *Discrete Mathematics and Its Applications*, 6TH edition, 2006, Mcgraw Hill Book Co.

<b>Course Name: English-II (Technical and Report Writing)</b>	
<b>Course Structure:</b> Lectures: 3 / Labs: 0	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> None	
<b>Objectives:</b> To develop efficient literature survey, analysis, report writing and document designing skills.	
<b>Course Outline:</b> 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.	
<b>Reference Material:</b> Greenfield, T., <i>Research Methods, Guidance for Postgraduates</i> , Arnold, 1996, 034064629.	

<b>Course Name: Probability and Statistics</b>	
<b>Course Structure:</b> Lectures: 3, Labs: 0	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> None	
<b>Objectives:</b> To introduce the concepts of data analysis, presentation, counting techniques, probability and decision making	
<b>Course Outline:</b> Introduction to Statistics, Descriptive Statistics, Statistics in decision making, Graphical representation of Data Stem-and Lead plot, Box-Cox plots, measures of central tendencies and dispersion, moments of frequency distribution; Counting techniques, introduction to probability, sample space, events, laws of probability, Conditional probability and Baye's theorem with application to random variable (Discrete and continuous) Binomial, Poisson, Geometric, Negative Binomial Distributions; Exponential Gamma and Normal distributions. Regression and Correlation, Estimation and testing of hypotheses, use of elementary statistical packages for explanatory Data analysis.	
<b>Reference Material:</b> 7. Ronald Walpole, Myers, Myers, Ye, "Probability & Statistics for Engineers & Scientists", 8 <sup>th</sup> edition, 2008, <b>Prentice Hall</b> Publisher.	

8. Lay L. Devore, Probability and Statistics for Engineering and the Sciences, 2003, Duxbury Publishers.
9. G. Cowan, *Statistical Data Analysis*, 1998, Clarendon, Oxford.

**Course Name: Fundamentals of Information Technology**

**Course Structure:** Lectures: 3

**Credit Hours:** 3

**Prerequisites:** Introduction to Computing (recommended)

**Objectives:**

To introduce students to the scope of the field of Information Technology, to give them a basic understanding of information, its organization, transmission, storage, retrieval and presentation, and to explore some of the computer based technologies used for these purposes.

**Course Outline:**

Introduction to the academic discipline of IT as well as the general meaning of IT as per objectives given in the start of this program. Definitions of information, information technology as the use of computer based technology to organize, store, retrieve, transmit and present information, sender/receiver/channel model for information transfer. Information organization via databases, data modeling, and information management systems. Basic network ideas and models. Differences in human and machine processing of information, information transfer at the human/machine interface, modalities for information presentation, advantages and disadvantages of various presentation media. Challenging issues for today's information and communication technologies, issues in organizational need assessment and management of large scale information systems, along with social, legal and ethical issues related with each topic.

**Suggested Text Book:**

5. Cyganski, David, John A. Orr and Richard F. Vaz, Information Technology Inside and Outside, Pearson Education (LPE), 2001
6. Information Technology: Principles, Practices, and Opportunities (3rd Edition) (Hardcover), by [James A. Senn](#) (Author), Prentice Hall; 3 edition (December 1, 2003), ISBN-10: 0131436260

**Reference Material:**

11. Cyganski, David, John A. Orr and Richard F. Vaz, Information Technology Inside and Outside, Pearson Education (LPE), 2001
12. Ray, Ajoy Kumar and Tinku Acharya, Information Technology: Principles and Applications, Prentice-Hall India, 2004
13. Information Technology: Principles, Practices, and Opportunities (3rd Edition) (Hardcover), by [James A. Senn](#) (Author), Prentice Hall; 3 edition (December 1, 2003), ISBN-10: 0131436260
14. Introduction to Information Technology (Hardcover), by [Efraim Turban](#) (Author), [Rex Kelly Rainer](#) (Author), [Richard E. Potter](#) (Author), Hardcover: 592 pages, Publisher:
15. Wiley; 2 edition (July 12, 2002), ISBN-10: 0471073806

Basic Electronics

**Semester 3.**

## Data Structure and Algorithms

<b>Course Name: Digital Logic And Design</b>
<b>Course Structure:</b> Lectures: 2 / Labs: 3   <b>Credit Hours: 3</b>
<b>Prerequisites:</b> Discrete Structures, Introduction to Computing
<b>Objectives:</b> 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.
<b>Course Outline:</b> 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, subtractors, 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 Machine (ASM) Charts, Asynchronous circuits, Memory systems, Functional organization, Multiprocessor and alternative architectures: Introduction to SIMD, MIMD, VLIW, EPIC; systolic architecture; interconnection networks; shared memory systems; cache coherence; memory models and memory consistency, Performance enhancements, Contemporary architectures.
<b>Reference Material:</b> <i>Digital Design, 2nd Ed., M. Morris Mano, Prentice Hall, 1991.</i> <i>Practical Digital Logic Design and Testing, P K Lala, Prentice Hall, 1996.</i>

<b>Course Name: Digital Logic And Design</b>
<b>Course Structure:</b> Lectures: 2 / Labs: 3   <b>Credit Hours: 3</b>
<b>Prerequisites:</b> Discrete Structures, Introduction to Computing
<b>Objectives:</b> 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.
<b>Course Outline:</b> 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, subtractors, 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 Machine (ASM) Charts, Asynchronous circuits, Memory systems, Functional organization, Multiprocessor and alternative

architectures: Introduction to SIMD, MIMD, VLIW, EPIC; systolic architecture; interconnection networks; shared memory systems; cache coherence; memory models and memory consistency, Performance enhancements, Contemporary architectures.

**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: Communication Skills English III**

**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 nonverbal 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.

**Course Name: Introduction to Database Systems**

**Course Structure:** Lectures: 2/Labs: 3 | **Credit Hours: 3**

**Prerequisites:** Data Structures and Algorithms

**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



<p><b>Course Outline:</b>                  Basic database concepts; Logical database Modelling and design: Entity Relationship diagram (ERD), Enhanced ERD Relational data model: mapping ERD to relational model, Functional dependencies and Normalization: 1st -3rd Normal Form and BCNF, Relational Algebra; Structured Query language (SQL); Fundamental knowledge about Transaction processing, concurrency control recovery techniques and query optimization concepts.</p>
<p><b>Reference Material:</b>                  9. C. J. Date, Database Systems, Addison Wesley Pub. Co.                  10. R. Elmasri and S. Navathe. Fundamentals of Database Systems, Benjamin/Cummings.                  11. Abraham Silberschatz, Henry F. Korth S. Sudarshan. "Database System Concepts".                  12. T. Connolly and C. Begg . "Database Systems, a Practical Approach to Design, Implementation and Management", Pearson education,.</p>

Sociology

## Semester 4.

<b>Course Name: Operating Systems</b>	
<b>Course Structure:</b> Lectures: 3, Labs: 1	<b>Credit Hours: 4</b>
<b>Prerequisites:</b> None	
<p><b>Objectives:</b> To help students gain a general understanding of the principles and concepts governing the functions of operating systems and acquaint students with the layered approach that makes design, implementation and operation of the complex OS possible.</p>	
<p><b>Course Outline:</b> 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.</p> <p>Lab assignments involving different single and multithreaded OS algorithms.</p>	
<p><b>Reference Material:</b>                  5. <i>Applied Operating Systems Concepts</i>, 7<sup>th</sup> Edition, Silberschatz A., Peterson, J.L., &amp; Galvin P.C. 2004.                  6. <i>Modern Operating Systems</i>, 3rd Edition, Tanenmaum A.S., 2008.</p>	

<b>Course Name: Computer Organization and Assembly Language</b>
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<b>Course Structure:</b> Lectures: 2, Labs: 1	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> Digital Logic Design	
<p><b>Objectives:</b> 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.</p>	
<p><b>Course Outline:</b> Microprocessor Bus Structure: Addressing, Data and Control, Memory Organization and Structure (Segmented and Linear Models), 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. Objectives and Perspectives of Assembly Language, Addressing Modes, Introduction to the Assembler and Debugger, Manipulate and translate machine and assembly code, Describe actions inside the processing chip, Discuss operations performed by an instruction set, Write a fully documented program, Using an assembler of choice.</p>	
<p><b>Reference Material:</b></p> <ol style="list-style-type: none"> <li>7. Stallings, "Computer Organization &amp; Architecture", 7<sup>th</sup> ed, Prentice HALL, 2006.</li> <li>8. Irvine, Assembly Language for Intel-based Computers, 5th ed, Prentice Hall, 2007.</li> <li>9. Computer Organization and Design, The Hardware/Software Interface, 4th ed, by David A. Patterson and John L. Hennessy, 2008. Elsevier Publishers.</li> </ol>	

<b>Course Name: Computer Graphics</b>	
<b>Course Structure:</b> Lectures: 2 / Labs: 3	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> Object Oriented Programming , Visual Programming	
<p><b>Objectives:</b> Study of various algorithms in computer graphics and their implementation in any programming language.</p>	
<p><b>Course Outline:</b> Graphics hardware. Fundamental algorithms. Applications of graphics. Interactive graphics programming — graph plotting, windows and clipping, and segmentation. Programming raster display systems, Differential Line Algorithm, panning and zooming. Raster algorithms and software — Scan-Converting lines, characters and circles. Scaling, Rotation, Translation, Region filling and clipping. Two and three dimensional imaging geometry (Perspective projection and Orthogonal projection) and transformations. Curve and surface design, rendering, shading, colour and animation.</p>	
<p><b>Reference Material:</b></p> <ol style="list-style-type: none"> <li>5. 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.</li> <li>6. <i>Computer Graphics</i>, F.S.Hill, Maxwell MacMillan ISBN: 0-02-354860-6.</li> </ol>	

3. Interactive Computer Graphics: Functional, Procedural and Device-level methods; Peter Burger and Duncan. F. Gillies; Addison-Wesley, (2003)

<b>Course Name: Computational Linear Algebra</b>	
<b>Course Structure:</b> Lectures: 2 / Labs: 1	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> Linear Algebra, Calculus	
<p><b>Objectives:</b> Students will gain familiarity with and facility in the use of standard techniques for the numerical solution of a variety of problems in linear algebra, including solutions of linear systems, various matrix operations, evaluation of determinants and permanents, calculation of eigenvalues and determination of eigenvectors. Students will be introduced to various discrete transforms and apply some specific transforms to the solution of simple problems. In all cases, students will be introduced to possible sources of error and techniques for estimating the magnitude.</p>	
<p><b>Course Outline:</b> Background matrix algebra, measuring vectors, matrices, subspaces, and linear system sensitivity, numerical matrix algebra, Gaussian elimination, special linear systems, orthogonalization and least squares methods, the unsymmetrical eigenvalues problem, the symmetric eigenvalues problem, Lanczos methods, iterative methods for linear systems, functions of matrices. Introduction of discrete transforms, discrete Fourier and cosine transforms and simple applications. Error analysis and estimation for all techniques studied.</p> <p><i>Sample labs and assignments:</i></p> <ul style="list-style-type: none"> <li>- Implementation and testing of algorithms for typical linear algebra problems, including an analysis of errors.</li> </ul>	
<p><b>Resources:</b></p> <ol style="list-style-type: none"> <li>1. Golub, G., and C. Van Loan, <i>Matrix Computations (3/e)</i>, 1996</li> <li>2. Sewell, G., <i>Computational Methods of Linear Algebra (2/e)</i>, 2005</li> <li>3. Nievergelt, Y., <i>Wavelets Made Easy</i>, 1999.</li> </ol>	

Economics  
Organizational Behavior

## Semester 5.

Introduction to Software Development

<b>Course Name: Web Systems and Technologies</b>	
<b>Course Structure:</b> Lectures: 3	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> Fundamentals of Information Technology (required)	

**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:**

In-depth study of World Wide Web architectures, protocols and standards (HTTP, HTML, XHTML, CGI, XML, WML, cHTML, etc.), Web Technologies and Tools (such as scripting tools) for web application development and deployment (web servers, application servers, etc.), Web Based Applications including search engines and content management, management of large scale web based information systems, Web Services, Web2, Semantic Web, and Web3, principles of web site design, practical exercise in web site development.

**Suggested Text Books:**

5. Nuckles, Craig, Web Applications: Concepts and Real World Design, Wiley 2006
6. Programming the World Wide Web (4th Edition) (Paperback), by [Robert W. Sebesta](#) (Author), Paperback: 752 pages, Publisher: Addison Wesley; 4th edition (August 17, 2007), ISBN-10: 0321489691

**Reference Material:**

17. Gosselin, Dan, et. al., The Web Warrior Guide to Web Design Technologies, Cengage Learning, 2003
18. Zak, Diane, et. al., The Web Warrior Guide to Web Programming, Cengage Learning, 2003
19. Leasure, T., Bob Leasure and James Leasure, The Web Warrior Guide to Web Database Technologies, Cengage Learning, 2003
20. Morrison, Mike and Joline Morrison, Database Driven Websites, 2/e, Cengage Learning, 2002
21. Web Wizard series for various technologies, Addison-Wesley
22. Jackson, J. C., Web Technologies: A Computer Science Perspective, Pearson (LPE), 2008
23. [Web Application Architecture: Principles, Protocols and Practices](#) by Leon Shklar and Richard Rosen (Paperback - Oct 31, 2008), Paperback: 420 pages, Publisher: Wiley; 2 edition (October 31, 2008), ISBN-10: 047051860X
24. [Web Engineering: The Discipline of Systematic Development of Web Applications](#) by Gerti Kappel, Birgit Prýýll, Siegfried Reich, and Werner Retschitzegger (Paperback - Jul 5, 2006)

<b>Course Name: Information Systems</b>	
<b>Course Structure:</b> Lectures: 3/Labs: 0	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> None	
<b>Objectives:</b> Major emphasis than is usual for Information Systems analysis, design, and success and management aspects will be placed in order to discuss the management of the technical processes involved. Actual Case Studies will be central to the delivery of the unit. Recent, well-accepted, developments in all aspects of Information Systems development will also be covered and discussed. This course will facilitate students to understand the advanced concepts of information systems.	
<b>Course Outline:</b> Introduction and Classification of Information Systems, Lifecycle of IS Projects, Major Taxonomies of Information Systems, IS Strategies, Types of IS Strategies, Business Strategies and Types, Alignment of both Strategies, Information Systems success and Failure, Critical Success Factors, Information Systems Project Evaluation, IS Feasibility Study and Types, Managing Information Systems Projects, Structure of IS Projects, Managing Conflicts in Information Systems projects, Role of CIO, System Analysis of IS Projects, Design Issues in IS, Coupling, Cohesion and Structured Charts, Team Composition, Detailed IS Design Issues, Advanced Design Issues, Measuring Project Complexity, Prototype Approaches, CASE Tools, Soft System Methods (SSM), Rapid Application Development (RAD), Case Studies.	
<b>Reference Material:</b> 3. Enterprise Information Systems, O'Brien and Marakas, 13th Edition, McGraw-Hill, 2007	

<b>Course Name: Data Warehousing</b>	
<b>Course Structure:</b> Lectures: 2/Labs: 3	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> Introduction to Database Systems	
<b>Objectives:</b> (a) to manage large database systems, (b) to monitor the processing of database system.	
<b>Course Outline:</b> Introduction of the business context for data warehousing and decision support systems. Differences between TPS and DSS environments. Data warehouse Architecture. Data Marts. Differentiate Data Marts and Data Warehouse. Evaluation of Data Warehouse. Data Warehouse Design Methodology: Entity Relationship Modeling and Dimensional Modeling. OLAP in data warehousing and different types of OLAP such as MOLAP, ROLAP and HOLAP. Indexing techniques used in data warehousing. Hardware and software systems consideration for data warehousing. Data warehouse maintenance.	

**Reference Material:**

7. Paulraj Ponniah, Data Warehousing Fundamentals, John Wiley & Sons Inc., NY.
8. W.H. Inmon, Building the Data Warehouse (Second Edition), John Wiley & Sons Inc., NY.
9. Ralph Kimball and Margy Ross, The Data Warehouse Toolkit (Second Edition), John Wiley & Sons Inc., NY.

Visual Programming

<b>Course Name: Financial Management</b>	
<b>Course Structure:</b> Lectures: 3 / Labs: 0	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> None	
<b>Course Outline:</b> Introduction to Financial Management, Concepts and Models in Valuation, The time value of money, Fundamentals of risk and portfolio analysis, Valuation of stocks and bonds, The capital Asset Pricing Model, the Arbitrage Pricing Model and other valuation models. The Cost of Capital: Capital structure and Dividend Policy, The cost of capital, Capital structure theory, Capital structure policy and optimal capital structure, Internal financing and dividends policy Capital Budgeting: The basis of capital budgeting, The determination and use of cash flow, Mutually exclusive investments and capital rationing, Annual equivalent cost and replacement decisions, Risk analysis and the optimal capital budget, Islamic guidelines for financial management: The rational of prohibition of interest, Alternate capital structure, Capital Budgeting in an Interest free economy, working Capital Management in 100% equity capital structure.	
<b>Reference Material:</b> <i>Financial Management</i> by Charles H. Gibson.	

**Semester 6.**

Computer Communications and Networks

<b>Course Name: Multimedia Systems and Design</b>	
<b>Course Structure:</b> Lectures: 2, Lab: 3	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> Fundamentals of Information Technology (required)	
<b>Objectives:</b> To introduce students to the complete process of multimedia system specification, design, testing, and prototyping, including the tools and techniques for integrating multimedia content (text, graphics, images, sound, animation, motion video and virtual reality) into a product, to present design principles and techniques to maximize the effectiveness of such products, and to give the students practice in the production using a variety of media and tools. Introduction to multimedia systems, multimedia applications and development tools.	

<p><b>Course Outline:</b> Introduction to multimedia systems, software, hardware, various equipment, video and audio capture, annotation, storage and playback techniques, multimedia software development tools, multimedia applications, step-by-step procedure in developing multimedia systems: (specification, design, testing, and prototyping), multimedia standards, Student projects - developing multimedia systems in the laboratory.</p>
<p><b>Suggested Text Books:</b></p> <ol style="list-style-type: none"> <li>7. <a href="#">Multimedia: Making it Work, Seventh Edition</a> by Tay Vaughan (Paperback - Dec 20, 2006)</li> <li>8. Shuman, James, Multimedia Concepts, Enhanced Edition, Cengage Learning, 2002</li> <li>9. Lake, Susan and Karen Bean, Digital Multimedia: The Business of Technology, Cengage Learning, 2007</li> </ol>
<p><b>Reference Material:</b></p> <ol style="list-style-type: none"> <li>7. Z. M. Li; M. S. Drew: Fundamentals of Multimedia. Prentice Hall 2004, ISBN: 0-13-127256-X</li> <li>8. N. Chapman; J. Chapman: Digital Multimedia. (2nd ed.), Wiley 2004, ISBN: 0-470-85890-7</li> <li>9. Villalobos, Ray, Exploring Multimedia for Designers, Cengage Learning, 2007.</li> </ol>

<b>Course Name: Technology Management</b>	
<b>Course Structure:</b> Lectures: 3/Labs: 0	<b>Credit Hours: 3</b>
Prerequisites: None	
<b>Objectives:</b>	
(a) to introduce basic management functions, focusing on technology management issues,	
(b) case study to appraise students real problems	
<b>Course Outline:</b>	
Introduction and issues in technology management; Basic management functions (Planning, Control, Decision making, organizing etc.); Business Change and Technology challenges and issues; Technology strategy, goals and objectives, common hurdles; Technology transfer issues related to hardware, software, communications, human resources, etc.; IT as change enabling technology, assessment and selection of technology, training planning, equipment and systems acquisition processes; Implementation processes; Common challenges in change management; Small case study.	
<b>Reference Material:</b>	
7. Robins Stephan, "Management"	
8. Griffwn, "Principles of Management"	
9. Robert Williams and Marks Walla. "The Ultimate Window 2000 System Administration's Guide.	

<b>Course Name: Telecommunication Systems</b>
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<b>Course Structure:</b> Lectures:3 Labs: 0/3	<b>Credit Hours:</b> ¾
<b>Prerequisites:</b> None	
<b>Objectives:</b> To provide a first level exposure to the broad domain of telecommunication Systems	
<b>Course Outline:</b> Introduction to media, bandwidth and noise. Twisted pair (UTP, STP), coaxial cables (types and specifications), optical fibres (types and losses), Introduction to optical sources and detectors. Microwave links, satellite communication and infrared links. Frequency Division Multiplexing (FDM), TDM, FDMA, TDMA and CDMA. Switching: circuit and packet switching. Introduction to mobile and cellular communications. Block diagram and current trends.	
<b>Reference Material:</b>	
7. <i>Introduction to Telecommunications Network Engineering</i> , 2nd edition, T. Aattalinen, Artech House 2003, ISBN: 1580535003.	
8. <i>Fundamentals of Telecommunication Networks</i> , T. Saadawi, Wiley US, ISBN: 0471515825.	
9. <i>Telecommunication Systems</i> , P. G. Fonteolliet, Artech House 1991.	

Knowledge Based Systems

Marketing

## Semester 7.

Human Computer Interaction

<b>Course Name: System Programming</b>		
<b>Course Structure:</b> Lectures: 2 / Labs: 3	<b>Credit Hours:</b> 3	
<b>Prerequisites:</b> Operating Systems		
<b>Objectives:</b> Demonstrate mastery of the internal operation of Unix system software including assemblers, loaders, macro-processors, interpreters, interprocess communication.		
<b>Course Outline:</b> 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.		
<b>Reference Material:</b>		
1. <i>The UNIX Programming Environment</i> , B. Kernighan & R. Pike Prentice-Hall, 1984.		
2. <i>System Software</i> , Leland L. Beck, Addison-Wesley Longmsan, 1990, ISBN: 0-201-50945-8.		

<b>Course Name: Network Security</b>		
<b>Course Structure:</b> Lectures: 3/Labs: 0	<b>Credit Hours:</b> 3	<b>Semester:</b> 7



<b>Prerequisites:</b> Computer Communication and Network
<b>Course Outline:</b> Principles and Practices of network security, security threats and methods to avoid them, authentication applications, electronic mail security, electronic transaction security and digital signatures, IP security, web security, system security, intruders and viruses, firewalls, introduction to cryptographic algorithms, standard security protocols, cyber crime, policy and regulations.
<b>Reference Material:</b> 5. Cryptography and Network Security: Principles and Practice, 4/E, William Stallings, Prentice Hall, 2005. 6. Government Policy documents on security issues.

<b>Course Name: System Integration and Architecture</b>	
<b>Course Structure:</b> Lectures: 3 / Labs: 0	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> Fundamentals of Information Technology (Required), Introduction to Software Development (Recommended)	
<b>Objectives:</b> This course will prepare the students to understand the system level requirements of an organization and acquire the required information and communication resources, integrate and deploy these resources in the form of a system.	
<b>Course Outline:</b> System level requirements gathering and analysis, acquisition, sourcing, integration, project management, testing and quality assurance, organizational context and architecture., intersystem's communication, data mapping and exchange, integrative coding, scripting techniques, software security and an overview of programming languages.	
<b>Suggested Text Books:</b> 3. Enterprise Integration: An Architecture for Enterprise Application and Systems Integration (Paperback), by <a href="#">Fred A. Cummins</a> (Author), Paperback: 496 pages, Publisher: Wiley; 1st edition (February 1, 2002), ISBN-10: 0471400106	

<b>Course Name: System and Network Administration</b>		
<b>Course Structure:</b> Lectures: 2/Labs: 1	<b>Credit Hours: 3</b>	<b>Semester: 5</b>
<b>Suggested Prerequisites:</b> Computer Communication and Networks, Operating Systems		

**Objectives:**

This course will give an overview of systems and network administration based on both Windows and Linux environments. The objective are common system administration tasks and practices and how to implement and maintain standard services like email, file sharing, DNS and similar. The course is primarily dealing with the Linux and Windows operating systems and especially with Linux-based servers and Window-based clients, but some information about the most fundamental differences between various Linux systems will be provided. In labs focus is on how to install, setup and maintain Linux server machine and to perform various system administration and security related tasks on those machines.

**Course Outline:**

Brief introduction to the Networks, Homogenous and Heterogeneous networks, Issues involved in the setup of Heterogeneous networks, File systems, Configuration issues, Fundamentals of Linux user interface, Installation and administration of heterogeneous networks using Windows and Linux platforms. System installation, booting and halting the system, file systems and directory permission structures, print and disk quotas, device configuration and management, user account administration, security, client administration, disk maintenance, remote access, remote administration, the use of schedulers, the use of advanced scripting to ease system administration tasks, configuration management, template implementation and cross directory implementation.

**Suggested Textbooks:**

**Reference Material:**

7. Practice of System and Network Administration, the 2<sup>nd</sup> Edition by Thomas A, Limoncelli, Hogan, 2005.
8. Windows Administration Latest Edition, Microsoft Press
9. Linux Administration Guide Latest Edition

## Semester 8.

IT Capstone

Professional Practices

<b>Course Name: Human Resource Management</b>	
<b>Course Structure:</b> Lectures: 3 / Labs: 0	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> None	
<b>Course Outline:</b> An overview of Human Resource Management and Human Resource Manager. The Environment of Human Resource Management, external and Internal Environment. Equal Employment Opportunity and Affirmative Action. Job Analysis: A Basic Human Resource Tool. Human Resource Planning, Recruitment, and Selection. Organization Change and Human Resource Development. Corporate Culture and Organization Development. Career Planning Development. Performance Appraisal.	
<b>Reference Material:</b> <i>Managing Human Resource</i> by Wayne F. Cascio.	

**Outlines Of Road Map BS (IT) 2014-18 and onward****Semester 1.**

<b>Course Name: Programming Fundamentals</b>	
<b>Course Structure:</b> Lectures: 3, Labs: 1	<b>Credit Hours: 4</b>
<b>Prerequisites:</b> None	
<b>Objectives:</b> 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.	
<b>Course Outline:</b> Overview of computers and programming. Overview of language for e.g. C language C. Basics of structured and Modular programming. Basic 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.	
<b>Reference Material:</b>	
7. Problem Solving and Program Design in C / 6E Hanly & Koffman Addison-Wesley   Published: 02/06/2009 ISBN-10: 0321535421   ISBN-13: 9780321535429	
8. C How to Program, 5/E <b>(Harvey &amp; Paul) Deitel &amp; Deitel</b> , ISBN-10: 0132404168 ISBN-13: 9780132404167 Publisher: Prentice Hall Copyright: 2007	

<b>Course Name: Introduction to Information and Communication Technologies</b>	
<b>Course Structure:</b> Lectures: 2 / Labs: 3	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> None (first semester course)	
<b>Objectives:</b>	
This course focuses on a breadth-first coverage of the use of computing and communication technologies to solve real life problems; including computing environments, general application software like word processing, visual presentation applications, tabular data manipulation, DBMS, WWW, Email management systems, Virus, Anti-Virus and Spam Protection; Introduction to the basic computing hardware (main building blocks), operating systems, data networks; software engineering and communication technology along with social and ethical issues. An introduction of the program of study in computing for which this course is being taught (CS, IT, SE etc.). The course attempts to provide every student a set of productivity tools that they will be able to use for the rest of their lives.	

**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 Communication Technology, Operating system, Compiler, DBMS, Computer networks and internet, WWW, web mail applications, Computer graphics, AI, Viruses and Anti-Viruses, Use of office productivity tools, such as word processors, spreadsheets, presentation applications, etc., Social, Ethical, Professional and Legal Issues, and overview of the complete program of studies in computing and its structure.

**Suggested Text Book:**  
 1. Introduction to Computers by Peter Norton, 6th Edition, McGraw-Hill SiE, ISBN 0-07-059374-4.

**Reference Material:**  
 1. Computers: Information Technology in Perspective, 9/e by Larry Long and Nancy Long, Prentice Hall, 2002/ISBN: 0130929891.  
 2. An Invitation to Computer Science, Schneider and Gersting, Brooks/Cole Thomson Learning, 2000.  
 3. Information System Today by Leonard Jessup, Joseph Valacich.  
 4. Computers Today by Suresh K. Basandra.  
 5. Computer Science: An overview of Computer Science, Sherer.

<b>Course Name: English-I (Functional English)</b>	
<b>Course Structure:</b> Lectures: 3 / Labs: 0	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> None	
<b>Objectives:</b> To develop good English writing, language usage and reading skills.	
<b>Course Outline:</b> 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.	
<b>Reference Material:</b> <i>Warriner's English Grammar and Composition</i> , John E. Warriner	

<b>Course Name: Islamic &amp; Pakistan Studies</b>	
<b>Course Structure:</b> Lectures: 3 / Labs: 0	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> None	
<p><b>Objectives:</b> 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</p>	
<p><b>Course Outline:</b> 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.</p>	
<p><b>Reference Material:</b>  <i>Chaudary M. Ali, The Emergence of Pakistan, 1967.</i>  <i>K.K.Aziz, The making of Pakistan, 1976.</i></p>	

<b>Course Name: Calculus and Analytic Geometry</b>	
<b>Course Structure:</b> Lectures: 3, Labs: 0	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> None	
<p><b>Objectives:</b> To provide foundation and basic ground for calculus and analytical geometry background.</p>	
<p><b>Course Outline:</b> 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.</p>	
<p><b>Reference Material:</b></p> <ol style="list-style-type: none"> <li>1. Swokowski, Olinick and Pence, <i>Calculus and Analytical Geometry, 6<sup>th</sup> edition, 1994, Brooks/Cole Publishers.</i></li> <li>2. Howard Anton, <i>Calculus, 7<sup>th</sup> edition. 2002, John Wiley and Sons (WIE).</i></li> <li>3. William E. Boyce Richard C. Diprima, <i>Calculus, John Wiley &amp; Sons, ISBN:</i></li> </ol>	

0471093335.

4. Thomas Finny, Calculus and Analytical Geometry, 10th edition, John Wiley and Sons.
5. Erwin Kreyzig, Advanced Engineering Mathematics, 7th edition, 1993, John Wiley & Sons Inc.

## Semester 2.

<b>Course Name: Object Oriented Programming</b>	
<b>Course Structure:</b> Lectures: 2, Labs: 1	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> Programming Fundamentals	
<b>Objectives:</b> The course aims to focus on object-oriented concepts, analysis and software development.	
<b>Course Outline:</b> Evolution of Object Oriented (OO) programming, OO concepts and principles, problem solving in OO paradigm, OO program 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	
<b>Reference Material:</b>	
1. C++ How to Program, 6/E (Harvey & Paul) Deitel & Deitel ISBN-10: 0136152503 ISBN-13: 9780136152507 Publisher: Prentice Hall	
2. Java How to Program, 7/E (Harvey & Paul) Deitel & Deitel ISBN-10: 0132222205 ISBN-13: 9780132222204 Publisher: Prentice Hall	

<b>Course Name: Discrete Structures</b>	
<b>Course Structure:</b> Lectures: 3 / Labs: 0	<b>Credit Hours: 3</b>
<b>Prerequisites: None</b>	
<b>Objectives:</b> 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. In this course more emphasis shall be given to statistical and probabilistic formulation with respect to computing aspects.	
<b>Course Outline:</b> Introduction to logic and proofs: Direct proofs; proof by contradiction, Sets, Combinatorics, Sequences, Formal logic, Propositional and predicate calculus, Methods of Proof, Mathematical Induction and Recursion, loop invariants, Relations and functions, Pigeonhole principle, Trees and Graphs, Elementary number theory, Optimization and matching. Fundamental structures: Functions; relations (more specifically recursions); pigeonhole principle; cardinality and countability, probabilistic methods.	
<b>Reference Material:</b>	
1. Kenneth H. Rosen, <i>Discrete Mathematics and Its Applications</i> , 6TH edition, 2006, McGraw Hill Book Co.	

<b>Course Name: English-II (Technical and Report Writing)</b>	
<b>Course Structure:</b> Lectures: 3 / Labs: 0	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> None	
<b>Objectives:</b> To develop efficient literature survey, analysis, report writing and document designing skills.	
<p><b>Course Outline:</b> 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.</p> <p>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 versus hierarchical structure documents.</p>	
<p><b>Reference Material:</b> Greenfield, T., Research Methods, Guidance for Postgraduates, Arnold, 1996, 034064629.</p>	

<b>Course Name: Probability and Statistics</b>	
<b>Course Structure:</b> Lectures: 3, Labs: 0	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> None	
<b>Objectives:</b> To introduce the concepts of data analysis, presentation, counting techniques, probability and decision making	
<p><b>Course Outline:</b> Introduction to Statistics, Descriptive Statistics, Statistics in decision making, Graphical representation of Data Stem-and Lead plot, Box-Cox plots, measures of central tendencies and dispersion, moments of frequency distribution; Counting techniques, introduction to probability, sample space, events, laws of probability, Conditional probability and Baye's theorem with application to random variable (Discrete and continuous) Binomial, Poisson, Geometric, Negative Binomial Distributions; Exponential Gamma and Normal distributions. Regression and Correlation, Estimation and testing of hypotheses, use of elementary statistical packages for explanatory Data analysis.</p>	
<p><b>Reference Material:</b></p> <ol style="list-style-type: none"> <li>1. Ronald Walpole, Myers, Myers, Ye, "Probability &amp; Statistics for Engineers &amp; Scientists", 8<sup>th</sup> edition, 2008, <b>Prentice Hall</b> Publisher.</li> <li>2. Lay L. Devore, Probability and Statistics for Engineering and the Sciences, 2003, Duxbury Publishers.</li> <li>3. G. Cowan, <i>Statistical Data Analysis</i>, 1998, Clarendon, Oxford.</li> </ol>	

<b>Course Name: Fundamentals of Information Technology</b>	
<b>Course Structure:</b> Lectures: 3	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> Introduction to Computing (recommended)	
<b>Objectives:</b> To introduce students to the scope of the field of Information Technology, to give them a basic understanding of information, its organization, transmission, storage, retrieval and presentation, and to explore some of the computer based technologies used for these purposes.	
<b>Course Outline:</b> Introduction to the academic discipline of IT as well as the general meaning of IT as per objectives given in the start of this program. Definitions of information, information technology as the use of computer based technology to organize, store, retrieve, transmit and present information, sender/receiver/channel model for information transfer. Information organization via databases, data modeling, and information management systems. Basic network ideas and models. Differences in human and machine processing of information, information transfer at the human/machine interface, modalities for information presentation, advantages and disadvantages of various presentation media. Challenging issues for today's information and communication technologies, issues in organizational need assessment and management of large scale information systems, along with social, legal and ethical issues related with each topic.	
<b>Suggested Text Book:</b> 7. Cyganski, David, John A. Orr and Richard F. Vaz, Information Technology Inside and Outside, Pearson Education (LPE), 2001 8. Information Technology: Principles, Practices, and Opportunities (3rd Edition) (Hardcover), by <a href="#">James A. Senn</a> (Author), Prentice Hall; 3 edition (December 1, 2003), ISBN-10: 0131436260	
<b>Reference Material:</b> 16. Cyganski, David, John A. Orr and Richard F. Vaz, Information Technology Inside and Outside, Pearson Education (LPE), 2001 17. Ray, Ajoy Kumar and Tinku Acharya, Information Technology: Principles and Applications, Prentice-Hall India, 2004 18. Information Technology: Principles, Practices, and Opportunities (3rd Edition) (Hardcover), by <a href="#">James A. Senn</a> (Author), Prentice Hall; 3 edition (December 1, 2003), ISBN-10: 0131436260 19. Introduction to Information Technology (Hardcover), by <a href="#">Efraim Turban</a> (Author), <a href="#">Rex Kelly Rainer</a> (Author), <a href="#">Richard E. Potter</a> (Author), Hardcover: 592 pages, Publisher: 20. Wiley; 2 edition (July 12, 2002), ISBN-10: 0471073806	

Basic Electronics



**Semester 3.**

Data Structure and Algorithms

<b>Course Name: Digital Logic And Design</b>	
<b>Course Structure:</b> Lectures: 2 / Labs: 3	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> Discrete Structures, Introduction to Computing	
<b>Objectives:</b> 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.	
<b>Course Outline:</b> 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, subtractors, 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 Machine (ASM) Charts, Asynchronous circuits, Memory systems, Functional organization, Multiprocessor and alternative architectures: Introduction to SIMD, MIMD, VLIW, EPIC; systolic architecture; interconnection networks; shared memory systems; cache coherence; memory models and memory consistency, Performance enhancements, Contemporary architectures.	
<b>Reference Material:</b> <i>Digital Design</i> , 2nd Ed., M. Morris Mano, Prentice Hall, 1991. <i>Practical Digital Logic Design and Testing</i> , P K Lala, Prentice Hall, 1996.	

<b>Course Name: Digital Logic And Design</b>	
<b>Course Structure:</b> Lectures: 2 / Labs: 3	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> Discrete Structures, Introduction to Computing	
<b>Objectives:</b> 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.	
<b>Course Outline:</b> 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, subtractors, 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 Machine (ASM) Charts, Asynchronous circuits, Memory systems, Functional organization, Multiprocessor and alternative	

architectures: Introduction to SIMD, MIMD, VLIW, EPIC; systolic architecture; interconnection networks; shared memory systems; cache coherence; memory models and memory consistency, Performance enhancements, Contemporary architectures.

**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: Communication Skills English III**

**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 nonverbal 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.

**Course Name: Introduction to Database Systems**

**Course Structure:** Lectures: 2/Labs: 3 | **Credit Hours: 3**

**Prerequisites:** Data Structures and Algorithms

**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

<p><b>Course Outline:</b>                  Basic database concepts; Logical database Modelling and design: Entity Relationship diagram (ERD), Enhanced ERD Relational data model: mapping ERD to relational model, Functional dependencies and Normalization: 1st -3rd Normal Form and BCNF, Relational Algebra; Structured Query language (SQL); Fundamental knowledge about Transaction processing, concurrency control recovery techniques and query optimization concepts.</p>
<p><b>Reference Material:</b>                  13. C. J. Date, Database Systems, Addison Wesley Pub. Co.                  14. R. Elmasri and S. Navathe. Fundamentals of Database Systems, Benjamin/Cummings.                  15. Abraham Silberschatz, Henry F. Korth S. Sudarshan. "Database System Concepts".                  16. T. Connolly and C. Begg . "Database Systems, a Practical Approach to Design, Implementation and Management", Pearson education,.</p>

Sociology

### Semester 4.

<b>Course Name: Operating Systems</b>	
<b>Course Structure:</b> Lectures: 3, Labs: 1	<b>Credit Hours: 4</b>
<b>Prerequisites:</b> None	
<p><b>Objectives:</b> To help students gain a general understanding of the principles and concepts governing the functions of operating systems and acquaint students with the layered approach that makes design, implementation and operation of the complex OS possible.</p>	
<p><b>Course Outline:</b> 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.</p> <p>Lab assignments involving different single and multithreaded OS algorithms.</p>	
<p><b>Reference Material:</b>                  7. <i>Applied Operating Systems Concepts</i>, 7<sup>th</sup> Edition, Silberschatz A., Peterson, J.L., &amp; Galvin P.C. 2004.                  8. <i>Modern Operating Systems</i>, 3rd Edition, Tanenmaum A.S., 2008.</p>	

<b>Course Name: Computer Organization and Assembly Language</b>	
<b>Course Structure:</b> Lectures: 2, Labs: 1	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> 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:** Microprocessor Bus Structure: Addressing, Data and Control, Memory Organization and Structure (Segmented and Linear Models), 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.

Objectives and Perspectives of Assembly Language, Addressing Modes, Introduction to the Assembler and Debugger, Manipulate and translate machine and assembly code, Describe actions inside the processing chip, Discuss operations performed by an instruction set, Write a fully documented program, Using an assembler of choice.

**Reference Material:**

10. Stallings, "Computer Organization & Architecture", 7<sup>th</sup> ed, Prentice HALL, 2006.
11. Irvine, Assembly Language for Intel-based Computers, 5th ed, Prentice Hall, 2007.
12. Computer Organization and Design, The Hardware/Software Interface, 4th ed, by David A. Patterson and John L. Hennessy, 2008. Elsevier Publishers.

<b>Course Name: Computer Graphics</b>	
<b>Course Structure:</b> Lectures: 2 / Labs: 3	<b>Credit Hours:</b> 3
<b>Prerequisites:</b> Object Oriented Programming , Visual Programming	
<b>Objectives:</b> Study of various algorithms in computer graphics and their implementation in any programming language.	
<b>Course Outline:</b> Graphics hardware. Fundamental algorithms. Applications of graphics. Interactive graphics programming — graph plotting, windows and clipping, and segmentation. Programming raster display systems, Differential Line Algorithm, panning and zooming. Raster algorithms and software — Scan-Converting lines, characters and circles. Scaling, Rotation, Translation, Region filling and clipping. Two and three dimensional imaging geometry (Perspective projection and Orthogonal projection) and transformations. Curve and surface design, rendering, shading, colour and animation.	
<b>Reference Material:</b>	
7. 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.	
8. <i>Computer Graphics</i> , F.S.Hill, Maxwell MacMillan ISBN: 0-02-354860-6.	
3. Interactive Computer Graphics: Functional, Procedural and Device-level methods; Peter Burger and Duncan. F. Gillies; Addison-Wesley, (2003)	

**Course Name: Computational Linear Algebra**

<b>Course Structure:</b> Lectures: 2 / Labs: 1	<b>Credit Hours:</b> 3
<b>Prerequisites:</b> Linear Algebra, Calculus	
<p><b>Objectives:</b> Students will gain familiarity with and facility in the use of standard techniques for the numerical solution of a variety of problems in linear algebra, including solutions of linear systems, various matrix operations, evaluation of determinants and permanents, calculation of eigenvalues and determination of eigenvectors. Students will be introduced to various discrete transforms and apply some specific transforms to the solution of simple problems. In all cases, students will be introduced to possible sources of error and techniques for estimating the magnitude.</p>	
<p><b>Course Outline:</b> Background matrix algebra, measuring vectors, matrices, subspaces, and linear system sensitivity, numerical matrix algebra, Gaussian elimination, special linear systems, orthogonalization and least squares methods, the unsymmetrical eigenvalues problem, the symmetric eigenvalues problem, Lanczos methods, iterative methods for linear systems, functions of matrices. Introduction of discrete transforms, discrete Fourier and cosine transforms and simple applications. Error analysis and estimation for all techniques studied.</p> <p><i>Sample labs and assignments:</i></p> <ul style="list-style-type: none"> <li>- Implementation and testing of algorithms for typical linear algebra problems, including an analysis of errors.</li> </ul>	
<p><b>Resources:</b></p> <ol style="list-style-type: none"> <li>1. Golub, G., and C. Van Loan, <i>Matrix Computations (3/e)</i>, 1996</li> <li>2. Sewell, G., <i>Computational Methods of Linear Algebra (2/e)</i>, 2005</li> <li>3. Nievergelt, Y., <i>Wavelets Made Easy</i>, 1999.</li> </ol>	

Economics

Organizational Behavior

## Semester 5.

Introduction to Software Development

<b>Course Name: Web Systems and Technologies</b>	
<b>Course Structure:</b> Lectures: 3	<b>Credit Hours:</b> 3
<b>Prerequisites:</b> Fundamentals of Information Technology (required)	
<p><b>Objectives:</b></p> <p>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.</p>	

**Course Outline:**

In-depth study of World Wide Web architectures, protocols and standards (HTTP, HTML, XHTML, CGI, XML, WML, cHTML, etc.), Web Technologies and Tools (such as scripting tools) for web application development and deployment (web servers, application servers, etc.), Web Based Applications including search engines and content management, management of large scale web based information systems, Web Services, Web2, Semantic Web, and Web3, principles of web site design, practical exercise in web site development.

**Suggested Text Books:**

7. Nuckles, Craig, Web Applications: Concepts and Real World Design, Wiley 2006
8. Programming the World Wide Web (4th Edition) (Paperback), by [Robert W. Sebesta](#) (Author), Paperback: 752 pages, Publisher: Addison Wesley; 4th edition (August 17, 2007), ISBN-10: 0321489691

**Reference Material:**

1. Gosselin, Dan, et. al., The Web Warrior Guide to Web Design Technologies, Cengage Learning, 2003
2. Zak, Diane, et. al., The Web Warrior Guide to Web Programming, Cengage Learning, 2003
3. Leasure, T., Bob Leasure and James Leasure, The Web Warrior Guide to Web Database Technologies, Cengage Learning, 2003
4. Morrison, Mike and Joline Morrison, Database Driven Websites, 2/e, Cengage Learning, 2002
5. Web Wizard series for various technologies, Addison-Wesley
6. Jackson, J. C., Web Technologies: A Computer Science Perspective, Pearson (LPE), 2008
7. [Web Application Architecture: Principles, Protocols and Practices](#) by Leon Shklar and Richard Rosen (Paperback - Oct 31, 2008), Paperback: 420 pages, Publisher: Wiley; 2 edition (October 31, 2008), ISBN-10: 047051860X
8. [Web Engineering: The Discipline of Systematic Development of Web Applications](#) by Gerti Kappel, Birgit Prýýll, Siegfried Reich, and Werner Retschitzegger (Paperback - Jul 5, 2006)

<b>Course Name: Information Systems</b>	
<b>Course Structure:</b> Lectures: 3/Labs: 0	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> None	
<b>Objectives:</b> Major emphasis than is usual for Information Systems analysis, design, and success and management aspects will be placed in order to discuss the management of the technical processes involved. Actual Case Studies will be central to the delivery of the unit. Recent, well-accepted, developments in all aspects of Information Systems development will also be covered and discussed. This course will facilitate students to understand the advanced concepts of information systems.	
<b>Course Outline:</b> Introduction and Classification of Information Systems, Lifecycle of IS Projects, Major Taxonomies of Information Systems, IS Strategies, Types of IS Strategies, Business Strategies and Types, Alignment of both Strategies, Information Systems success and Failure, Critical Success Factors, Information Systems Project Evaluation, IS Feasibility Study and Types, Managing Information Systems Projects, Structure of IS Projects, Managing Conflicts in Information Systems projects, Role of CIO, System Analysis of IS Projects, Design Issues in IS, Coupling, Cohesion and Structured Charts, Team Composition, Detailed IS Design Issues, Advanced Design Issues, Measuring Project Complexity, Prototype Approaches, CASE Tools, Soft System Methods (SSM), Rapid Application Development (RAD), Case Studies.	
<b>Reference Material:</b> 4. Enterprise Information Systems, O'Brien and Marakas, 13th Edition, McGraw-Hill, 2007	

<b>Course Name: Data Warehousing</b>	
<b>Course Structure:</b> Lectures: 2/Labs: 3	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> Introduction to Database Systems	
<b>Objectives:</b> (a) to manage large database systems, (b) to monitor the processing of database system.	
<b>Course Outline:</b> Introduction of the business context for data warehousing and decision support systems. Differences between TPS and DSS environments. Data warehouse Architecture. Data Marts. Differentiate Data Marts and Data Warehouse. Evaluation of Data Warehouse. Data Warehouse Design Methodology: Entity Relationship Modeling and Dimensional Modeling. OLAP in data warehousing and different types of OLAP such as MOLAP, ROLAP and HOLAP. Indexing techniques used in data warehousing. Hardware and software systems consideration for data warehousing. Data warehouse maintenance.	

**Reference Material:**

10. Paulraj Ponniah, Data Warehousing Fundamentals, John Wiley & Sons Inc., NY.
11. W.H. Inmon, Building the Data Warehouse (Second Edition), John Wiley & Sons Inc., NY.
12. Ralph Kimball and Margy Ross, The Data Warehouse Toolkit (Second Edition), John Wiley & Sons Inc., NY.

Visual Programming

<b>Course Name: Financial Management</b>	
<b>Course Structure:</b> Lectures: 3 / Labs: 0	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> None	
<b>Course Outline:</b> Introduction to Financial Management, Concepts and Models in Valuation, The time value of money, Fundamentals of risk and portfolio analysis, Valuation of stocks and bonds, The capital Asset Pricing Model, the Arbitrage Pricing Model and other valuation models. The Cost of Capital: Capital structure and Dividend Policy, The cost of capital, Capital structure theory, Capital structure policy and optimal capital structure, Internal financing and dividends policy Capital Budgeting: The basis of capital budgeting, The determination and use of cash flow, Mutually exclusive investments and capital rationing, Annual equivalent cost and replacement decisions, Risk analysis and the optimal capital budget, Islamic guidelines for financial management: The rational of prohibition of interest, Alternate capital structure, Capital Budgeting in an Interest free economy, working Capital Management in 100% equity capital structure.	
<b>Reference Material:</b> <i>Financial Management</i> by Charles H. Gibson.	

**Semester 6.**

Computer Communications and Networks

<b>Course Name: Multimedia Systems and Design</b>	
<b>Course Structure:</b> Lectures: 2, Lab: 3	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> Fundamentals of Information Technology (required)	
<b>Objectives:</b> To introduce students to the complete process of multimedia system specification, design, testing, and prototyping, including the tools and techniques for integrating multimedia content (text, graphics, images, sound, animation, motion video and virtual reality) into a product, to present design principles and techniques to maximize the effectiveness of such products, and to give the students practice in the production using a variety of media and tools. Introduction to multimedia systems, multimedia applications and development tools.	



**Course Outline:**

Introduction to multimedia systems, software, hardware, various equipment, video and audio capture, annotation, storage and playback techniques, multimedia software development tools, multimedia applications, step-by-step procedure in developing multimedia systems: (specification, design, testing, and prototyping), multimedia standards, Student projects - developing multimedia systems in the laboratory.

**Suggested Text Books:**

10. [Multimedia: Making it Work, Seventh Edition](#) by Tay Vaughan (Paperback - Dec 20, 2006)
11. Shuman, James, Multimedia Concepts, Enhanced Edition, Cengage Learning, 2002
12. Lake, Susan and Karen Bean, Digital Multimedia: The Business of Technology, Cengage Learning, 2007

**Reference Material:**

10. Z. M. Li; M. S. Drew: Fundamentals of Multimedia. Prentice Hall 2004, ISBN: 0-13-127256-X
11. N. Chapman; J. Chapman: Digital Multimedia. (2nd ed.), Wiley 2004, ISBN: 0-470-85890-7
12. Villalobos, Ray, Exploring Multimedia for Designers, Cengage Learning, 2007.

<b>Course Name: Technology Management</b>	
<b>Course Structure:</b> Lectures: 3/Labs: 0	<b>Credit Hours: 3</b>
Prerequisites: None	
<b>Objectives:</b> (a) to introduce basic management functions, focusing on technology management issues, (b) case study to appraise students real problems	
<b>Course Outline:</b> Introduction and issues in technology management; Basic management functions (Planning, Control, Decision making, organizing etc.); Business Change and Technology challenges and issues; Technology strategy, goals and objectives, common hurdles; Technology transfer issues related to hardware, software, communications, human resources, etc.; IT as change enabling technology, assessment and selection of technology, training planning, equipment and systems acquisition processes; Implementation processes; Common challenges in change management; Small case study.	
<b>Reference Material:</b> 10. Robins Stephan, "Management" 11. Griffwn, "Principles of Management" 12. Robert Williams and Marks Walla. "The Ultimate Window 2000 System Administration's Guide."	

<b>Course Name: Telecommunication Systems</b>	
<b>Course Structure:</b> Lectures:3 Labs: 0/3	<b>Credit Hours:</b> ¾
<b>Prerequisites:</b> None	
<b>Objectives:</b> To provide a first level exposure to the broad domain of telecommunication Systems	
<b>Course Outline:</b> Introduction to media, bandwidth and noise. Twisted pair (UTP, STP), coaxial cables (types and specifications), optical fibres (types and losses), Introduction to optical sources and detectors. Microwave links, satellite communication and infrared links. Frequency Division Multiplexing (FDM), TDM, FDMA, TDMA and CDMA. Switching: circuit and packet switching. Introduction to mobile and cellular communications. Block diagram and current trends.	
<b>Reference Material:</b>	
10. <i>Introduction to Telecommunications Network Engineering</i> , 2nd edition, T. Aattalinen, Artech House 2003, ISBN: 1580535003.	
11. <i>Fundamentals of Telecommunication Networks</i> , T. Saadawi, Wiley US, ISBN: 0471515825.	
12. <i>Telecommunication Systems</i> , P. G. Fonteolliet, Artech House 1991.	

Knowledge Based Systems  
Marketing

### Semester 7.

Human Computer Interaction

<b>Course Name: System Programming</b>	
<b>Course Structure:</b> Lectures: 2 / Labs: 3	<b>Credit Hours:</b> 3
<b>Prerequisites:</b> Operating Systems	
<b>Objectives:</b> Demonstrate mastery of the internal operation of Unix system software including assemblers, loaders, macro-processors, interpreters, interprocess communication.	
<b>Course Outline:</b> 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.	
<b>Reference Material:</b>	
1. <i>The UNIX Programming Environment</i> , B. Kernighan & R. Pike Prentice-Hall, 1984.	
2. <i>System Software</i> , Leland L. Beck, Addison-Wesley Longmsan, 1990, ISBN:	

<b>Course Name: Network Security</b>		
<b>Course Structure:</b> Lectures: 3/Labs: 0	<b>Credit Hours:</b> 3	<b>Semester:</b> 7
<b>Prerequisites:</b> Computer Communication and Network		
<b>Course Outline:</b> Principles and Practices of network security, security threats and methods to avoid them, authentication applications, electronic mail security, electronic transaction security and digital signatures, IP security, web security, system security, intruders and viruses, firewalls, introduction to cryptographic algorithms, standard security protocols, cyber crime, policy and regulations.		
<b>Reference Material:</b> 7. Cryptography and Network Security: Principles and Practice, 4/E, William Stallings, Prentice Hall, 2005. 8. Government Policy documents on security issues.		

<b>Course Name: System Integration and Architecture</b>		
<b>Course Structure:</b> Lectures: 3 / Labs: 0	<b>Credit Hours:</b> 3	
<b>Prerequisites:</b> Fundamentals of Information Technology (Required), Introduction to Software Development (Recommended)		
<b>Objectives:</b> This course will prepare the students to understand the system level requirements of an organization and acquire the required information and communication resources, integrate and deploy these resources in the form of a system.		
<b>Course Outline:</b> System level requirements gathering and analysis, acquisition, sourcing, integration, project management, testing and quality assurance, organizational context and architecture., intersystem's communication, data mapping and exchange, integrative coding, scripting techniques, software security and an overview of programming languages.		
<b>Suggested Text Books:</b> 4. Enterprise Integration: An Architecture for Enterprise Application and Systems Integration (Paperback), by <a href="#">Fred A. Cummins</a> (Author), Paperback: 496 pages, Publisher: Wiley; 1st edition (February 1, 2002), ISBN-10: 0471400106		

<b>Course Name: System and Network Administration</b>		
<b>Course Structure:</b> Lectures: 2/Labs: 1	<b>Credit Hours:</b> 3	<b>Semester:</b> 5
<b>Suggested Prerequisites:</b> Computer Communication and Networks, Operating Systems		

<p><b>Objectives:</b>                  This course will give an overview of systems and network administration based on both Windows and Linux environments. The objective are common system administration tasks and practices and how to implement and maintain standard services like email, file sharing, DNS and similar. The course is primarily dealing with the Linux and Windows operating systems and especially with Linux-based servers and Window-based clients, but some information about the most fundamental differences between various Linux systems will be provided. In labs focus is on how to install, setup and maintain Linux server machine and to perform various system administration and security related tasks on those machines.</p>
<p><b>Course Outline:</b>                  Brief introduction to the Networks, Homogenous and Heterogeneous networks, Issues involved in the setup of Heterogeneous networks, File systems, Configuration issues, Fundamentals of Linux user interface, Installation and administration of heterogeneous networks using Windows and Linux platforms. System installation, booting and halting the system, file systems and directory permission structures, print and disk quotas, device configuration and management, user account administration, security, client administration, disk maintenance, remote access, remote administration, the use of schedulers, the use of advanced scripting to ease system administration tasks, configuration management, template implementation and cross directory implementation.</p>
<p><b>Suggested Textbooks:</b></p> <p><b>Reference Material:</b>                  10. Practice of System and Network Administration, the 2<sup>nd</sup> Edition by Thomas A, Limoncelli, Hogan, 2005.                  11. Windows Administration Latest Edition, Microsoft Press                  12. Linux Administration Guide Latest Edition</p>

## Semester 8.

IT Capstone  
 Professional Practices

<b>Course Name: Human Resource Management</b>	
<b>Course Structure:</b> Lectures: 3 / Labs: 0	<b>Credit Hours: 3</b>
<b>Prerequisites:</b> None	
<b>Course Outline:</b> An overview of Human Resource Management and Human Resource Manager. The Environment of Human Resource Management, external and Internal Environment. Equal Employment Opportunity and Affirmative Action. Job Analysis: A Basic Human Resource Tool. Human Resource Planning, Recruitment, and Selection. Organization Change and Human Resource Development. Corporate Culture and Organization Development. Career Planning Development. Performance Appraisal.	
<b>Reference Material:</b>	

**Road Map BS(IT) 2010-14  
(As submitted to Controller office)**

<b>Semester-1</b>			
<b>Sr #</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Credit Hours</b>
1	CS-301	Programming Fundamentals	4 (3-1)
2	IT-301	Introduction to Information and Communication Technologies	4(3-1)
3	EG-301	English-I (Functional English)	3 (3-0)
4	SS- 301	Islamic and Pakistan Studies	3 (3-0)
5	MT-301	Calculus and Analytical Geometry	3 (3-0)
		<b>Total</b>	<b>17</b>
<b>Semester-2</b>			
<b>Sr #</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Credit Hours</b>
1	CS-302	Object Oriented Programming	3 (2-1)
2	CS-304	Discrete Structures	3 (3-0)
3	EG-302	English-II (Technical and Report Writing)	3 (3-0)
4	MT-202	Probability and Statistics	3 (3-0)
5	IT-302	Fundamentals of Information Technology	3 (3-0)
6	EE-302	Basic Electronics	3 (3-0)
		<b>Total</b>	<b>18</b>
<b>Semester-3</b>			
<b>Sr #</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Credit Hours</b>
1	CS-401	Data Structure and Algorithms	3 (2-1)
2	CS-403	Digital Logic and Design	3 (2-1)
3	CS-407	Theory of Automata & Formal Languages	3 (3-0)
4	EG-401	English-III (Communication Skills)	3 (3-0)
5	CS-405	Introduction to Database Systems	4 (3-1)
6	SS-403	Sociology	3 (3-0)
		<b>Total</b>	<b>19</b>
<b>Semester-4</b>			
<b>Sr #</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Credit Hours</b>

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1	CS-402	Operating Systems	3 (2-1)
2	CS-404	Computer Organization and Assembly Language	3 (2-1)
3	CS-406	Computer Graphics	3 (2-1)
4	MT-402	Linear Algebra	3 (3-0)
5	SS-404	Economics	3 (3-0)
6	SS-402	Organizational Behavior	3 (3-0)
<b>Total</b>			<b>18</b>

**Semester-5**

Sr #	Course Code	Course Title	Credit Hours
1	CSI-501	Introduction to Software Development	3 (3-0)
2	CIT-501	Web Systems and Technologies	3(2-1)
3	CIT-502	Information Systems	3 (3-0)
4	CSI-503	Data Warehousing	3(2-1)
5	CSI-505	Visual Programming	3(2-1)
6	MG-421	Financial Management	3(3-0)
<b>Total</b>			<b>18</b>

**Semester-6**

Sr #	Course Code	Course Title	Credit Hours
1	CSI-502	Computer Communications and Networks	3 (2-1)
2	CIT-502	Multimedia Systems and Design	3(2-1)
3	CIT-504	Technology Management	3 (3-0)
4	CSI-504	Telecommunication Systems	3(3-0)
5	CSI-506	Knowledge Based Systems	3(2-1)
6	BBA-502	Marketing	3(3-0)
<b>Total</b>			<b>18</b>

**Semester-7**

Sr #	Course Code	Course Title	Credit Hours
1	CSI-601	Human Computer Interaction	3 (3-0)
2	CSI-603	System Programming	3(2-1)
3	CIT-601	Network Security	3(3-0)
4	CIT-603	System Integration and Architecture	3(3-0)

5	CIT-605	Systems and Network Administration	3(2-1)
<b>Total</b>			<b>15</b>

**Road Map BS(IT) 2011-15  
(As submitted to Controller office)**

<b>Semester-1</b>			
Sr #	Course Code	Course Title	Credit Hours
1	CS-301	Programming Fundamentals	4 (3-1)
2	IT-301	Introduction to Information and Communication Technologies	4(3-1)
3	EG-301	English-I (Functional English)	3 (3-0)
4	SS- 301	Islamic and Pakistan Studies	3 (3-0)
5	MT-301	Calculus and Analytical Geometry	3 (3-0)
<b>Total</b>			<b>17</b>
<b>Semester-2</b>			
Sr #	Course Code	Course Title	Credit Hours
1	CS-302	Object Oriented Programming	3 (2-1)
2	CS-304	Discrete Structures	3 (3-0)
3	EG-302	English-II (Technical and Report Writing)	3 (3-0)
4	MT-202	Probability and Statistics	3 (3-0)
5	IT-302	Fundamentals of Information Technology	3 (3-0)
6	EE-302	Basic Electronics	3 (3-0)
<b>Total</b>			<b>18</b>
<b>Semester-3</b>			
Sr #	Course Code	Course Title	Credit Hours
1	CSI-401	Data Structure and Algorithms	3 (2-1)
2	CSI-403	Digital Logic and Design	3 (2-1)
3	CSI-407	Theory of Automata & Formal Languages	3 (3-0)
4	ENG-421	English-III (Communication Skills)	3 (3-0)
5	CSI-405	Introduction to Database Systems	4 (3-1)
6	SOC-403	Sociology	3 (3-0)
<b>Total</b>			<b>19</b>
<b>Semester-4</b>			

Sr #	Course Code	Course Title	Credit Hours
1	CSI-402	Operating Systems	3 (2-1)
2	CSI-404	Computer Organization and Assembly Language	3 (2-1)
3	CSI-406	Computer Graphics	3 (2-1)
4	MTH-402	Linear Algebra	3 (3-0)
5	ECO-404	Economics	3 (3-0)
6	BBA-402	Organizational Behavior	3 (3-0)
		<b>Total</b>	<b>18</b>

### Semester-5

Sr #	Course Code	Course Title	Credit Hours
1	CSI-501	Introduction to Software Development	3 (3-0)
2	CIT-501	Web Systems and Technologies	3(2-1)
3	CIT-502	Information Systems	3 (3-0)
4	CSI-503	Data Warehousing	3(2-1)
5	CSI-505	Visual Programming	3(2-1)
6	BBA-421	Financial Management	3(3-0)
		<b>Total</b>	<b>18</b>

### Road Map BS(IT) 2012-16 (As submitted to controller office)

### Semester-1

Sr #	Course Code	Course Title	Credit Hours
1	CSI-301	Programming Fundamentals	4 (3-1)
2	CIT-301	Introduction to Information and Communication Technologies	4(3-1)
3	ENG-321	English-I (Functional English)	3 (3-0)
4	ISL- 302	Islamic and Pakistan Studies	3 (3-0)
5	MTH-301	Calculus and Analytical Geometry	3 (3-0)
		<b>Total</b>	<b>17</b>

### Semester-2

Sr #	Course Code	Course Title	Credit Hours
1	CSI-302	Object Oriented Programming	4 (3-1)
2	CSI-304	Discrete Structures	3 (3-0)



*Scheme of Studies BS IT*

3	ENG-322	English-II (Technical and Report Writing)	3 (3-0)
4	STA-351	Probability and Statistics	3 (3-0)
5	CIT-302	Fundamentals of Information Technology	3 (3-0)
6	EEE-321	Basic Electronics	3 (3-0)
<b>Total</b>			<b>19</b>

**Semester-3**

<b>Sr #</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Credit Hours</b>
1	CSI-401	Data Structure and Algorithms	3 (2-1)
2	CSI-403	Digital Logic and Design	3 (2-1)
3	CSI-407	Theory of Automata & Formal Languages	3 (3-0)
4	ENG-421	English-III (Communication Skills)	3 (3-0)
5	CSI-405	Introduction to Database Systems	4 (3-1)
6	SOC-403	Sociology	3 (3-0)
<b>Total</b>			<b>19</b>

**Road Map BS(IT) 2013-17 (As submitted to controller office)**

**Semester-1**

<b>Sr #</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Credit Hours</b>
1	CSI-301	Programming Fundamentals	4 (3-1)
2	CIT-301	Introduction to Information and Communication Technologies	4(3-1)
3	ENG-321	English-I (Functional English)	3 (3-0)
4	ISL- 321	Islamic Studies	3 (3-0)
5	MTH-301	Calculus and Analytical Geometry	3 (3-0)
<b>Total</b>			<b>17</b>

**The End**