FIRST YEAR

CT-153 PROGRAMMING LANGUAGES — Credit Hours: 3

Language: Definition, structures, Survey of some programming languages, special and general purpose languages, data types. Comparative study by means of primitive and composite data structures, Control structures by means of expression of algorithms.

Recommended Books:

1. "*Turbo C*", Robert Lafore, Financial Times Prentice Hall, Rev Sub Edition, 1988.
2. "*Let us C*", Yashwant P. Kanetkar, Jones & Bartlett Publishers, 8th Edition, 2008.

CT-157 DATA STRUCTURE ALGORITHMS & APPLICATIONS — Credit Hours: 4

A detailed study of the basic data structures commonly used in data processing; Techniques for data manipulation in structures such as stacks, queues, linked lists trees and graphs, management of memory space and overflow, sorting, and hash table methods; Searching and merging files, implementation and evaluation of various programming assignments.

Recommended Books:

1. "*Data Structures and Algorithms*", Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, Pearson Education Inc., Fourth Impression, 2009.
2. "*Data Structure*", D. Samanta, Prentice Hall, 2003.
3. *"Theory and Problems of Data structures"*, Seymour Lipschutz, Schaum's Outline Series, McGraw Hill Book Co., 1986.

CT-158 FUNDAMENTALS OF INFORMATION TECHNOLOGY — Credit Hours: 2

Introduction to IT, recent advances in IT, IT systems, Development of the modern Computer. Introduction to Software, data structures, coding. Programming and problem solving algorithms. Data types and representation. Basic organization of Computer, Number systems. Introduction to Data Communication, Database, I.S & MIS, Networks & Internet concepts.

Recommended Books:

1. "*Introduction of Computers*", Peter Norton, Glencoe/McGraw-Hill, 5th Edition, 2002.
2. "*Computer Communication Information*", Sarah E. Hutchinson and Stacey C. Sawyer, McGraw-Hill Book Co., 7th Edition, 1999.

CT-162 DISCRETE STRUCTURES

Credit Hours: 3

Mathematical logic, Sets, Functions, Algorithms, Complexity of Algorithms, Mathematical reasoning, Induction, Recursion, Sequences and Sums, Recursive Definitions, Recursive Algorithms, Counting, The Pigeonhole Principal, Permutations and Combinations, Binomial Coefficients, Discrete Probability, Expected Value and Variance, Recurrence Relations, Solving Recurrence Relations, Divide-and-Conquer Relations, Generating Functions, Inclusion-Exclusion Relations and their Properties, Representing Relations, Closures of Relations, Equivalence Relations, Partial Ordering, Introduction to Graphs, Graph Terminology, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest Path Problems, Introduction to Trees, Applications of Trees, Tree Traversal, Spanning Trees, Minimum Spanning Trees, Boolean Algebra, Boolean Functions, Representing Boolean Functions, Logic Gates, Minimization of Circuits, Modeling Computation, Languages and Grammars, Finite-State Machines with Output, Finite-State Machines with No Output, Language Recognition.

Recommended Books:

1. *"Discrete Mathematics and its Applications"*, Kenneth H. Rosen, McGraw Hill Science/Engineering/Math, 6th Edition, 2006.
2. *"Mathematical Structures for Computer Science"*, Judith L. Gersting, W. H. Freeman, 6th Edition, 2006.

CT-172 COMPUTING WORKSHOP

Credit Hours: 2

Partitioning and formatting Hard Disk. Installation of different operating systems (e.g. DOS, Windows, Linux, etc). Installation of dual Operating Systems. Maintenance of Personal Computer. Installation of application software. Viruses- Types of viruses and safeguard against them. Learning and practicing of office suite: Word Processing, Spread Sheet, Database, and Presentation tools. Introduction to Networking and Internet: Topologies, Layers, Configurations, Intranet and Internet Protocols and Browsing.

Recommended Books:

1. *"PC Upgrade and Repair Bible"*, Barry Press and Marcia Press, Wiley Publishing Inc., 2004.
2. *"A+ Complete Study Guide"*, David Groth, Sybex, 3rd Edition, 2003.

EE-119 FUNDAMENTALS OF ELECTRICAL ENGINEERING

Credit Hours: 4

Fundamental Electric Circuit Laws and Theorems: Energy, Electrical charge, Current, Potential Difference, Power and Energy, Faraday's Law, Lenz's Law, Ohm's Law, KCL, KVL, electrical sources (voltage and current sources), resistances, capacitances and inductances.

Basic of DC and AC Circuit Analysis: Introduction to loop current and node voltage, Mesh and Nodal analysis, Theorem, Norton Theorem, Superposition Theorem, periodic functions, RMS and effective and reactive power, maximum power transfer theorem, introduction to polyphase.

Magnetic Circuits and Transformers: Magnetic effects of electrical current, magnetic materials and magnetization, Hysteresis and eddy currents, self and mutual inductance, introduction to ideal transformer, equivalent circuit of transformer, losses and efficiency of transformer.

Introduction to DC and AC Machines: DC shunt, series and separately excited machines, internal generated voltage equation, losses in DC machines, speed control of DC machines. AC induction motors, working principle, construction, speed control, single phase induction motors, Control systems in machines, introduction to Synchronous machines.

Recommended Books:

1. *"Engineering Circuit Analysis"*, William Hayt, Jack Kemmerly and Steven Durbin, McGraw Hill Science/Engineering/Math, 8th Edition, 2011.
2. *"Fundamentals of Electric Circuits"*, Charles K. Alexander and Mathew Sadiku, McGraw Hill Science/Engineering/Math, 4th Edition, 2008.

EL-134 BASIC ELECTRONICS **Credit Hours: 4**

Semiconductor Diodes: Donor and Acceptor Impurities, Zero biased, Forward biased and Reverse biased junction Diodes, Junction Diode Current Equation. Depletion barrier width and junction capacitance, diffusion capacitance, Zener and Avalanche breakdown, Hall effect.

Power Supply Circuits: Half-wave & Full wave rectification, smoothing capacitor and filters, Ripple, Regulation and Regulated Power Supplies.

Bipolar & Field Effect Transistors: Bipolar & FET Principles, Basic circuit configuration, Voltage, Current and Power gains, Concept of input and output impedance, Low Frequency High Frequency small signal models, h-pattern Bandwidth. Introduction to amplifier coupling and feedback.

Oscillators: Principle of oscillation. Transistors & IC oscillators. Stability in oscillation.

Recommended Books:

1. *"Electronic Devices"*, Thomas L. Floyd, Prentice Hall, 8th Edition, 2007.
2. *"Electronic Devices and Circuits"*, Jacob Millman and Christos C. Halkias, McGraw Hill Inc., 1967.

Credit Hours: 3

MT-173 CALCULUS

Vectors
Review of vectors, Vector derivatives. Line and surface Integrals. Gradient of a Scalar.

Complex Number
Argand diagram, De Moivre formula, root of polynomial equations, curve and regions in the complex plane, standard functions and their inverses (exponential, circular and hyperbolic functions).

Limits and Continuity
Bounds and bounded sets, Limit point of sets, Sequences, Convergence of sequences monotonic sequences, Function and their graph, limit of function and continuous functions.

Differential Calculus
Differentiation and Successive differentiation and its application; Leibnitz theorem, Taylor and Maclaurin theorems with remainders in Cauchy and Lagrange form, Taylor and Maclaurin series, L'Hopitals Rule, extreme values of a function of one variable using first and second derivative test, asymptotes of a function, curvature and radius of curvature of a curve, partial differentiation, exact differential and its application in computing errors, Multivariate functions, Maxima and Minima for multivariate functions, Maxima Minima under certain conditions (Lagrange Multiplier).

Integral Calculus
Indefinite integrals and their computational techniques, reduction formulae definite integrals and their convergence, Beta and Gamma functions and their identities, double and triple integration with applications. (Area, volume, centroid, inertia, arc length).

Vector Algebra
Scalar and Vector quantities, physical and geometrical meanings. Algebra of vectors. Scalar and Vector triple products.

Recommended Books:

1. *"Engineering Mathematics"*, Anthony Croft, Robert Davison and Martin Hargreaves, Pearson Education Limited, 3rd Edition, 2001.
2. *"Calculus"*, Thomas & Finney, 3rd Edition, Addison Wesley Longman, 2006.
3. *"Engineering Mathematics"*, K. A. Stroud and Dexter J. Booth, 6th Edition, Industrial Press, 2007.
4. *"Calculus and Analytical Geometry"*, Howard Anton, John Wiley & Sons Inc, 5th Edition, 1998.
5. *"Complex Analysis for Mathematics and Engineering"*, John H. Mathews, Jones and Bartlett Publishers Inc., 5th Edition, 2006.

CY-105 APPLIED CHEMISTRY

Credit Hours: 4

Gases: Gas Laws; Kinetic Gas Equation; Van der Waals' Equation; Critical Phenomenon; Liquidification of gases, Specific heat (molar heat capacity).

Thermochemistry: Chemical Thermodynamics; Hess' Law; Heat of Reaction; Relation between H and U measurements of heat reaction; Bomb calorimeter.

Electrochemistry: Laws of Electrolysis; E.M.F. Series; Corrosion (Theories, Inhibition and Protection).

Water and Sewage: Sources of water; Impurities; Hardness; Water softening; Purification of Water for potable and industrial purposes; Electrodialysis; Introduction to Environmental Pollution; Main sources and effects; Sewage treatment.

Fuels: Types of fuels; Classification of Fossil fuels.

Metals and Alloys: Properties and general composition of metals and alloys such as Iron, Copper, Aluminum, Chromium and Zinc used in engineering field.

Engineering Materials: Inorganic Engineering materials; Cement; Glass; Organic Engineering materials; Polymer Rubbers; Plastics; paints; Semiconductors and Dielectric materials.

Lab Practicals: Determination of Alkalinity of a given sample; Determination of Total Acidity of a given sample; Determination of Total Hardness of a given sample of water; Determination of Surface Tension of a given sample; Determination of Coefficient of Viscosity of a given sample; Determination of Chloride Ions in a given sample; Determination of Carbonate Ions in a given sample; Determination of Turgidity in a given sample by Spectrophotometer; Plotting of Titration Curve and determination of Acidity in a given sample; Plotting a Calibration Curve and determination of ions present in a given sample.

Recommended Books:

1. *"Chemistry"*, R. Chang, McGraw Hill, 7th Edition, 2002.
2. *"General Chemistry"*, R. H. Petrucci, Prentice hall, 1996.
3. *"Physical Chemistry"*, P. W. Atkins, 7th Edition, Oxford University, 2003.
4. *"Textbook of Chemical Engineering"*, S. S. Dara, S. Chand & Company, 6th Edition, 1997.

PH-121 APPLIED PHYSICS

Credit Hours: 4

Introduction: Scientific notation and significant figures. Types of errors in experimental measurements. Units in different systems. Graphical Techniques (Log, semi-log and other non-linear graphs).

Vectors: Review of vectors, Vector derivatives. Line and surface Integrals. Gradient of a scalar.

Mechanics: The limits of Mechanics. Coordinate systems. Motion under constant acceleration, Newton laws and their applications. Galilean invariance. Uniform circular motion. Frictional forces. Work and Energy. Potential Energy. Energy conservation. Energy and our Environment. Angular momentum.

Electrostatics and Magnetism: Coulombs Law. Electrostatic potential energy of discrete charges. Continuous charge distribution. Gauss's Law. Electric field around conductors. Dielectrics. Dual trace oscilloscope with demonstration. Magnetic fields. Magnetic force on current. Hall effect. Biot-Savart Law. Ampere's Law. Fields of rings and coils. Magnetic dipole. Diamagnetism, Paramagnetism and Ferromagnetism.

Semiconductor Physics: Energy levels in a semiconductor. Hole concept. Intrinsic and Extrinsic regions. Law of Mass Action. P-N junction. Transistor. Simple circuits.

Waves and Oscillations: Free oscillation of systems with one and more degrees of freedom Solution for Modes. Classical wave equation. Transverse modes for continuous string. Standing waves. Dispersion relation for waves. LC network and coupled pendulums. Plasma oscillations.

Optics and Lasers: Harmonic travelling waves in one dimension .Near and far fields. Two-slit interference. Huygens Principle. Single-slit diffraction. Resolving power of optical instruments. Diffraction Grating. Lasers. Population inversion. Resonant cavities. Quantum efficiency. He-Ne, Ruby and CO2 lasers. Doppler effect and sonic boom.

Modern Physics: Inadequacy of classical physics, Planck's explanations of black body radiation Photoelectric effect, Compton effect. Bohr theory of Hydrogen atom, Atomic spectra, Reduce mass, De-Broglie hypothesis Braggs Law, Electron microscope, Uncertainty relations Modern atomic model, .Zeeman effect, Atomic nucleus, Mass-energy relation, Binding energy, Nuclear forces and fundamental forces, Exponential decay and half-life. Radioactive equilibrium in a chain, Secular equilibrium, Nuclear stability, Radiation detection instruments, Alpha decay, Beta decay, Gamma decay attenuation Nuclear radiation hazards and safety, Medical uses of Nuclear Radiation. Fission, Energy release. Nuclear Reactors. Breeder Reactor. Nuclear Fusion.

Recommended Books:

1. *"Physics Volume 1"*, David Halliday, Robert Resnick and Kenneth S. Krane, Wiley, 5th Edition, 2001.
2. *"Physics Volume 2"*, David Halliday, Robert Resnick and Kenneth S. Krane, Wiley, 5th Edition, 2001.

HS-102 ENGLISH **Credit Hours: 3**

Study Skills; Advanced reading Skills using variety of genre and texts; Listening and Speaking Skills: Oral communication Skills development; Precis writing; Controlled and guided writing; Essay Writing; Writing book and informal reports; Informal and formal letters and memos; Creating advertisements; Applied grammar: Sentence Correction, Sentence completion, Transformation of sentences, Question tags, Homonyms/Homophones sentence making, Punctuation extracts, conversation etc, Use of idioms.

Recommended Books:

1. *"Oxford Practice Grammar"*, John Eastwood, Oxford University Press, 2006.
2. *"A Quick English Reference"*, J. S. Hooper, Oxford University Press, 1981.

HS-105 PAKISTAN STUDIES **Credit Hours: 2**

Historical and Ideological Perspective of Pakistan Movement
Two Nation Theory: Definition - Claim of Muslims of being a separate nation from Hindus based upon cultural diversity significance. Cultural diversity and threats posed to Muslims rights and interests led to the demand of Pakistan – The Lahore Resolution.

Creation of Pakistan: Factors leading to the creation of Pakistan. Quaid-e-Azam and the demand of Pakistan.

Land of Pakistan: Geophysical conditions. Geopolitical and strategic importance of Pakistan. Natural resources-Minerals, Water and Power.

Constitutional Process: Early efforts to make constitution-problems and issues. Constitution of 1956 and its abrogation. Constitution of 1962 and its abrogation. Constitutional and Political crisis of 1971. Constitution of 1973. Recent Constitutional developments.

Contemporary issues in Pakistan:
Social issues: Literacy and education in Pakistan. State of science and technology with special reference to IT education. Pakistan; society and culture.

A brief survey of Pakistan's Economy: Agricultural and industrial development in Pakistan. Internal and external trade, Economic planning and prospects.

Environmental issues: Hazards of atmospheric pollution. Other forms of environmental degradation and their causes and solution. Pakistan's role in preservation of nature through international conventions/efforts.

Foreign Policy: Relations of Pakistan with neighbours. Relation of Pakistan with Super Powers. Relations of Pakistan with the Muslim World.

Human Rights

Conceptual foundations of Human Rights: What are Human Rights? Definition, significance and importance. Comparative analysis of Islamic and Western Perspective of Human rights.

UN Systems for Protection of Human Rights. An overview: UN Charter. International Bill of Human rights. Implementation mechanism.

Other Important international treaties and conventions: The Convention on the elimination of all forms of discrimination against women. International Convention on the rights of child(CRC).Convention against torture(CAT).Refugee Convention.

Pakistan's response to Human Rights at national and international level: Constitutional Provisions. Pakistan's obligations to international treaties and documents. Minority Rights in Pakistan. Pakistan's stand on violation of Human Rights in the international perspective.

Cultural Development in Pakistan: Definition, Contents and Contributing factors in culture. Development of Art, Philosophy and Literature.

Foreign Policy: Relation with neighbours, Super Powers and the Muslim World.

Recommended Books:

1. *"Pakistan Studies"*, M. R. Kazmi, Oxford University Press, 2007.
2. *"Constitutional and Political History of Pakistan"*, Hamid Khan, Oxford University Press, 2nd Edition, 2009.
3. *"Pakistan's Foreign Policy"*, Abdul Sattar, Oxford University Press, USA, Illustrated Edition, 2007.
4. *"Issues in Pakistan's Economy"*, Akbar Zaidi, Oxford University Press, USA, 2nd Edition, 2006.

HS-127 PAKISTAN STUDIES (FOR FOREIGNERS) Credit Hours: 2

Land of Pakistan: Land and People – Strategic importance, Important beautiful sights, National resources.

A brief Historical Background: A brief historical survey of Muslim community in the sub continent, British rule and its impacts, Indian reaction, Two nation theory, Origin and development factors leading towards the demand of a separate Muslim state, Creation of Pakistan.

Government and politics in Pakistan: Constitution of Pakistan: A brief outline, Government structure Federal and Provisional – Local Government Institution Political History, A brief account.

Language and Culture: Origin of Urdu Language, Influence of Arabic and Persian on Urdu Language and Literature, A short history of Urdu literature.

Recommended Books:

1. *"Pakistan Affairs"*, Ikram Rabbani, Caravan Book House, Lahore, 1997.
2. *"Old Roads, New Highways: 50 Years of Pakistan"*, Victoria Schofield, Oxford University Press, Pakistan, 1997.

SECOND YEAR

SE-201 OBJECT ORIENTED CONCEPTS & PROGRAMMING Credit Hours: 4

Evolution of Object Oriented (OO) Programming, OO concepts and principles, benefits of OO, problem solving in OO paradigm, OO programme design process, classes, methods, objects and encapsulation; constructors and destructors, operator and function overloading, virtual functions, derived classes, inheritance and polymorphism, I/O and file processing, exception handling, OOP concepts implementation using C++.

Recommended Books:

1. *"Understanding Object Oriented Programming"*, Timothy Budd, Addison Wesley, 3rd Edition, 1998.
2. *"C++: How to Program"*, Paul Deitel and Harvey Deitel, Pearson, 7th Edition, 2010.
3. *"Object Oriented Programming in C++"*, Robert Lafore, Sams Publishing, 4th Edition, 2002.
4. *"C++ Programming: From Problem Analysis to Program Design"*, D.S. Malik, Course Technology, 5th Edition, 2010.

SE-202 COMPUTER GRAPHICS Credit Hours: 4

Architecture and implementation of display interactive devices; Functional capabilities of graphics package. 2D and 3D viewing , clipping and transformation, human factors; Raster graphics scan conversion algorithms; Hidden surface and edges removal algorithms; Shading and texturing techniques; Application using commercial packages.

Recommended Books:

1. *"Computer Graphics using OpenGL"*, Francis S. Hill and Stephen M. Kelley, Prentice Hall, 3rd Edition, 2006.
2. *"Schaum's Outline Series of Computer Graphics"*, Zhigiang Kiang and Roy A. Plastock, McGraw-Hill, 2nd Edition, 2000.
3. *"Computer Graphics"*, Francis S. Hill, Prentice Hall, 3rd Edition, 2006.
4. *"Computer Graphics"*, Roy A. Plastock, McGraw-Hill, 2nd Edition, 2000.

SE-203 SOFTWARE REQUIREMENT ENGINEERING

Credit Hours: 4

Definition of requirements engineering and role in system development, Fundamental concepts and activities of requirements engineering, Information elicitation techniques, Modelling scenarios.

Fundamentals of goal-oriented requirements engineering, Modelling behavioral goals, Modelling quality goals, Goal modelling heuristics, Object modelling for requirements engineering, Object modelling notations, Object modelling heuristics, Identifying objects from goals, Modelling use cases and state machines, Deriving operational requirements from goals, Requirements Specification, Requirements verification and validation.

Management of inconsistency and conflict, requirements engineering risks, the role of quality goals in the requirements selection process, Techniques for requirements evaluation, selection and prioritization; Requirements management; Requirements traceability and impact analysis.

Recommended Books:

1. *"Requirements Engineering"*, Elizabeth Hull, Kenneth Jackson and Jeremy Dick, Springer, 2nd Edition, 2005.
2. *"Software Requirements"*, Karl E. Wiegers, Microsoft Press, 2nd Edition, 2003

SE-204 DATABASE MANAGEMENT SYSTEMS

Credit Hours: 4

File structures and file testing methods sequential, random and indexed sequential methods. Relational, Networks and Hierarchical data models, Organization, storage and retrieval methods. Functional dependency and normalization of database. Query processing and manipulation. Practical assignments and a project.

Recommended Books:

1. *"Database Systems"*, Thomas M. Connolly, Addison Wesley, 4th Edition, 2004.
2. *"Database Systems"*, C. J. Date, Addison Wesley, 8th Edition, 2003

SE-205 SOFTWARE ENGINEERING

Credit Hours: 4

Evolving role of Software, Definition and need of Software Engineering, Software Development Process, Software Process Models, Project Management concepts – People, Problem and Process, Software project estimations concepts & techniques. Metrics concepts types & their role, Software Quality Assurance, Introduction to Software testing concepts, Brief comparison of conventional methods for Software Engineering and new methods such as Object Oriented Software Engineering.

Recommended Books:

1. *"Software Engineering: A Practitioner's Approach"*, Roger S. Pressman, McGraw-Hill, 7th Edition, 2009.
2. *"Software engineering"*, Ian Sommerville, Addison Wesley, 9th Edition, 2010.
3. *"Software Engineering"*, Gregory W. Jones, Wiley, 1990.

SE-206 WEB ENGINEERING

Credit Hours: 4

WWW Technology: Internet and WWW History; The Internet and Intranets; Web Browsers & Web Servers; Web Application; URLs and navigation; TCP/IP and ports; HTTP Interaction; Client Request and Server Response; MIME; The Dynamic HTT P Protocol; Static vs. Dynamic Content; 3-Tier / n-Applications.

Web Site - Planning and Development: Web-site Goals; Planning Stages; Content Development; Site Map Development; Web-Site Design Principles; Making the site easy to navigate; Style Guides; Web-Site Hosting; Web-Site Design Tools; Web Page Programming Tools; Data Processing Tools; Maintaining and Monitoring the Web-Site.

Client Side Programming: HTML and DHTML – Tags, Linking, Forms, Event, Dynamic Style, Positioning; Document Object Model; Client Side Scripting Language - Data, Loops, Objects, Methods, Events; Java Script / VBScript; Browsers Variations; Java Script / VBScript Samples; Embedding Multimedia in Web Pages; Using ActiveX in Web.

Server Side Programming: Server Side Scripting Language; Web Server Configuration; Java / Active Server – Page Processing, Cookies, Built-in Objects; Web database access; ODBC and JDBC; Active Data Objects; Database Queries – SQL; Data Exchange and Interoperability – XML.

Concepts of Multimedia: Multimedia Hardware – Input and Capturing Devices, Output Devices Communication Devices; Multimedia Elements- Text Image Animation, Sound and Video; Text in Multimedia – Fonts. Its Attributes, Character Set, Mapping, Fonts Files: TTF, OTF; Image in Multimedia – Color Types, Compression File Formats: BMP, JPEG, GIF; Sound in Multimedia

– Recording Sound, Quality, MIDI, Digital Sound, File Formats: WAV, MP3; Video in Multimedia – Broadcast Standards, Digital Video, Compression, Recording Formats, File Format: AVI, MPEG, MOV.

Web Tools: Site Builders- Dreamweaver: Introduction, Working with Layers, Tables, Images, Forms and Frames, CSS, Site Navigation, Working with Layers, Behaviour; Web Animation – Flash: Drawing and Coloring tool, Animation in Flash, Treeing, Getting Interactive, Flash Scripting; File Transference – Cute FTP: Configuring web-site, Logs, Searching Transferring files, Stopping and Resuming, Scheduling.

Multimedia Tools
Font Editing Tools – Fontlab: Creating Font, Encoding Glyphs, Transformation, Hinting, Editing Font Metrics, Exporting.
Image Drawing and Editing Tools - Photoshop: Layers in Photoshop, Image Modifying and Adjusting, Using Channels, Masks and Action, Working with Filters.
Sound Editing Tools – Sound Forge: Sampling, Features, Mixing Sound Files, Recording, Filters.
Video Editing Tools – Premier: Video Clipping Joining, Slicing, Manage Time Line.

Recommended Books:

1. *"Web Enabled Commercial Application Development Using, HTML, DHTML, Java Script, Perl, CGI"*, Ivan Bayross, BPB Publications, 2009.
2. *"Principles of Web Design"*, Joel Sklar, Course Technology, 1st Edition, 2000.
3. *"Web Engineering: The Discipline of Systematic Development of Web Applications"*, Gerti Kappel, Birgit Proll and Seigfried Reich, John Wiley & Sons, 2006.

CS-251 LOGIC DESIGN & SWITCHING THEORY — Credit Hours: 4

Truth Functions: Binary connectives, Evaluation of Truth Functions, Physical realisations, Sufficient set of connectives. Truth Functional calculus. Boolean Algebra, Duality, Fundamental Theorems of Boolean Algebra, Switches and Relays, Logic Circuits, Speed and Delays in Logic Circuits. Minimization of Boolean Functions: Minterm and Maxterm, Karnaugh map, Simplification of Boolean Functions, POS and SOP expressions. Tabular Minimization: Prime Implicants. Sequential Networks: Latches, Fundamental Mode, Synthesis of Sequential Networks, Minimization of the number of states, Clocked networks, Special realizations and codes: Binary adders, Coding of numbers, Decoders and code conversion. ROMS, NAND and NOR Implementation, Parity Checkers.

Recommended Books:

1. *"Digital Logic and Computer Design"*, Morris M. Mano, Prentice Hall, 3rd Edition, 2003.
2. *"Digital Fundamentals"*, Thomas Floyd, Prentice Hall, 10th Edition, 2008.

CS-252 COMPUTER ARCHITECTURE & ORGANISATION Credit Hours: 4

Computer Evolution, Historical developments, System Buses, RAM, Access Methods, Performance Parameters, Cache Memory, Replacement Algorithms, Mapping Functions, Input & Output, I/O Modules. DMA, Computer Automatic Instruction sets: Characteristics and *Function, RISC* Control Unit Operation.

Recommended Books:

1. *"Computer Organization & Architecture"*, William Stallings, Prentice Hall, 8th Edition, 2009.

MT-273 DIFFERENTIAL EQUATIONS & LINEAR ALGEBRA Credit Hours: 3

Linear Algebra

Linearity and Linear dependence of vectors, basis, dimension of a vector space, field matrix and types of matrices (singular, non-singular, symmetric, non-symmetric, upper, lower, diagonal tridiagonal matrix), Rank of a matrix using row operations and special method, echelon and reduced echelon forms of a matrix, determination of consistency of a system of linear equation using rank, transitions matrix. Geometric representation of vector, norm of vector, Euclidean inner product, projections and orthogonal projections, Euclidean n spaces n properties Cauchy-Schwartz inequality, Euclidean transformations, apply geometric transformations to plane figure, composition of transformations. Eigen value and Eigen space.

Ordinary Differential Equations

Definitions (differential equation, general solution, particular solution, initial condition, boundary condition, initial homogenous and non-homogenous linear differential equations with constant coefficients, solutions of Euler differential equation, computation of particular integral of non-homogenous differential equations with problems.

Partial Differential Equations

Formation of partial differential equations, Solutions of first order linear and special types of second and higher order differential equations. Homogenous partial differential equations of order one. Lagrange multiplier.

Recommended Books:

1. *"Elementary Linear Algebra: Applications Version"*, Howard Anton and Chris Rorres, John Wiley & Sons Wiley, 10th Edition, 2010.
2. *"Differential Equations with Boundary Value Problems"*, Dennis G. Zill and Michael R. Cullen, Thomson Brooks/Cole Publishing, 7th Edition, 2009.
3. *"Advanced Engineering Mathematics"*, Erwin Kreyszig, John Wiley & Sons, 9th Edition, 2006.

4. *"Differential Equations: A modeling Perspective"*, Robert L. Borelli and Courtney S. Coleman, Wiley, 2nd Edition, 2004.

HS-205 ISLAMIC STUDIES **Credit Hours: 2**

Themetic Study of Holy Quran

Basic Islamic Beliefs

Tauheed: Al-Ambiya – 22, Al Baqarah – 163 – 164
Prophethood: Al-Imran – 79, Al-Hashr – 7, Al- Madina – 3
Hereafter: Al-Hajj – 5, Al- Baqarah – 48, and two Ahadith.

Basic Islamic Practices: Al-Mu'minun – 1-11

Amer-bil-Ma'roof wa Nahi Anil Munkar: The concept of Good and Evil; Importance and Necessity of Da'wat-e-Deen, Al-Imran – 110; Method of Da'wat-e-Deen. An-Nehl – 125, Al – Imran – 104. and two Ahadith.

Unity of the Ummah: Al-Imran – 103, Al-Hujurat – 10, Al-Imran – 64, Al-An'am – 108, and two Ahadith.

Kasb–e–Halal: Ta ha-81, Al-A'raf-32-33, Al-Baqarah-188, and two Ahadith.

Huquq-ul-Ibad
Protection of Life: Al-Maidah – 32
Right to Property: An-Nisa – 29
Right to Respect & Dignity: Al-Hujurat – 11-12
Freedom of Expression: Al-Baqarah – 256
Equality: Al-Hujurat – 13
Economic Security: Al-Ma'arij – 24-25
Employment Opportunity on Merit: An-Nisa – 58
Access to Justice: An-Nisa - 135

Women Rights: An-Nehl - 97, Al-Ahzab - 35, An-Nisa - 7
Relation With Non-Muslims: Al-Mumtahanah – 8-9, Al-Anfal – 61, and The last sermon of Hajj of Holy Prophet (PBUH) at Arafat on 10th Zil Haj – Relevant extracts.

Seerat (life) of the Holy Prophet (PBUH): Birth, life in Makkah, declaration of Prophethood, preaching and its difficulties, migration to Madina, Brotherhood (Mawakhat) and Madina Charter, the Holy Wars of the Prophet (Ghazwat-e-Nabawi), Hujjat-ul-Wida, the Last Sermon of Khutbat-ul-Wida: Translation and important points.

Islamic Civilisation:

In the Sub-Continent – Pre-Islamic civilization. The political, social and moral impacts of Islamic Civilisation.

In the World - Academic, intellectual, social and cultural impacts of Islam on the world.

Recommended Books:

1. *"Thematic Study of Holy Quran and Hadith"*, Saeedullah Qazi, Reprinted by NED University.
2. *"Life of the Prophet"*, Ibne Ishaq, Alfred Guillaume (Translator), Oxford University Press, 2002.

HS-208 BUSINESS COMMUNICATION & ETHICS Credit Hours: 3

Writing formal and business letters; Writing formal memos; Drafting notices and minutes of meetings; Drafting tender notice; Theoretical knowledge and comprehension of contracts and agreements; Preparing proposals and technical reports; Conducting and writing a project report on a mini research (sessional work); Conducting seminars and interviews; Writing and presenting conference papers; Solving IELTS type papers.

Communication Skills

Ways and means communicating; Using English for describing objects, procedures etc. oral and written language; Importance and elements of effective communication in business (oral and written communication).

Practice in report writing (business reports, documentation related to software engineering); Practice in conducting meetings and writing minutes; Practice in making effective presentations; Writing business letters and memos.

Ethics

Introduction: Objectives of the course; Definitions of (i) a code, (ii) ethics; Defining needs for a code of ethics.

Need for a Code of Ethics: For who and why; Review of Code of Ethics of other professional bodies of Pakistan. Summative analysis of ethics for professionals in general.

Recommended Books:

1. *"Business Communication"*, Mary Ellen Guffey, South-Western College Pub, 6th edition, 2007.
2. *"Business Communication"*, Kitty Locker, McGraw-Hill/Irwin, 4th Edition, 2008.

HS-209 ETHICAL BEHAVIOUR **Credit Hours: 2**

Introduction to Ethics: Definition of Ethics; Definition between normative and positive science; Problem of Freewill; Method of Ethics; Uses of Ethics.

Ethical Theories: History of Ethics - Greek Ethics, Medieval, Modern Ethics. Basic Concept of right and wrong: good and evil; Unilateralism, hedonism, Self-realisation – Egoism, intuitionism; Kant's moral philosophy.

Ethics & Religion: The relation of Ethics to Religion; Basic ethical principles of major religions: Hinduism, Judaism, Buddhism, Zoroastrianism, Christianity, Islam.

Ethics, Society, and moral theory: Ethical foundation of Rights and Duties; Applied Ethics; Society as the background of moral life; Universalism and Altruism; Theories of punishment.

Recommended Books:

1. *"An Introduction to Ethics"*, William Lillie, Barnes & Noble, 3rd Edition, reprinted 1974.
2. *"Philosophy: The Basics"*, Nigel Warburton, Routledge, London, 4th Edition, 2004.

THIRD YEAR

SE-301 SOFTWARE DESIGN & ARCHITECTURE **Credit Hours: 4**

Introduction - Putting Software Architecture in Context, Software Architecture as a Design Plan, and as an Abstraction, Four Views of Software Architecture, Engineering concerns addressed by different views.

Role of Architect - The Architect as a Key Technical Consultant, The Architect Makes Decisions, The Architect Coaches, The Architect Coordinates, The Architect Implements, The Architect Advocates, Software Architecture as a Career.

Global Analysis - Overview of Global Analysis Activities. Analysis Factors. Develop Strategies. Analyze Organizational, Product & Technical Factors.

Design activities for Conceptual/Module/Execution and Code Architecture Views; Design Activities and Central/Final Design Tasks for each type.

Recommended Books:

1. *"Software Architecture Design - Methodology and Styles"*, Lixin Tao, Xiang Fu and Kai Qian, Stipes Publishing L.L.C., 2006

2. *"Applied Software Architecture"*, Christine Hofmeister, Robert Nord and Dilip Soni, Addison Wesley Professional, 1st Edition, 2009.

3. *"Software Architecture and Design Illuminated"*, Kai Qian, Xiang Fu and Lixin Tao, Jones & Bartlett Publishers, 2009.

SE-302 HUMAN COMPUTER INTERACTION **Credit Hours: 3**

Background to human-computer interaction and concepts. Principles of human-computer interaction from psychology and cognitive science. User oriented perspective instead of system oriented. Task analysis: User-centred design, Usability engineering processes; conducting experiments, Conceptual models and metaphors, Designing interfaces: Coding techniques using colour, fonts, sound, animation, screen layout, response time, feedback, error messages. Technology: I/O, interaction styles, devices. Designing interfaces for special devices. Use of voice I/O, Internationalization and localization, help systems. User interface software architectures, Expressing design rationale for user interface design. Evaluation techniques. Communication between users and system developers.

Recommended Books:

1. *"HCI Models, Theories, and Frameworks: Toward a Multidisciplinary Science"*, John Carroll, Morgan Kaufmann, 1st Edition, 2003.
2. *"Usability Engineering: Scenario-Based Development of Human Computer Interaction"*, Mary Beth Rosson and John Carroll, Academic Press, 1st Edition, 2002.

SE-303 OPERATING SYSTEMS **Credit Hours: 4**

Introduction to Operating System, Operating System Structure; Concurrent Processes; CPU Scheduling; Deadlocks, Memory Management; Virtual Memory; File System; Emphasis on Character Base OS (i.e., Dos and UNIX).

Recommended Books:

1. *"Operating Systems Concepts"*, Abraham Silberschatz, Peter B. Galvin and Greg Gagne, John Wiley & Sons, 8th Edition, 2008.
2. *"Operating Systems: Internals and Design principles"*, William Stallings, Prentice Hall, 6th Edition, 2008.
3. *"Modern Operating Systems"*, Andrew S. Tanenbaum, Prentice Hall, 3rd Edition, 2007.

SE-304 COMPUTER AIDED ENGINEERING DRAWING

Credit Hours: 4

Introduction to Engineering Graphics. Geometrical Construction: Coordinate systems, basic entities, drawing geometric objects. Orthographic Projection: Projection theory, projection of principle views from 3D models, projection of the 3rd principle view from other two principle views. Dimensioning and tolerancing. Isometric drawing theory and techniques. Section views: Types of section views, sectioning techniques. 3D modeling.

Recommended Books:

1. *"Engineering Drawing and Design"*, Cecil Jensen, J.D. Helsel, D.R. Short, McGraw-Hill, 7th Edition, 2007.
2. *"Basic Engineering Drawing"*, Roland S. Rhodes and Leo B. Cook, Longman, 2nd Edition, 1990.
3. *"Engineering Drawing with a Primer on Autocad"*, Arshad N. Siddiquee, Prentice Hall, 2003.
4. *"Computer Aided Engineering Design"*, Anupam Saxena and Birendra Sahay, Springer, 2005.

SE-305 SOFTWARE QUALITY ENGINEERING

Credit Hours: 4

Introduction to SQA, The Quality Challenge, Quality Control and Quality Assurance, Quality Assurance in Software Projects (Phases), Principles and Practices, Quality Management, Quality Assurance and Standards, Quality Planning and Quality Control, Verification and Validation, Planning Verification and Validation, Reliability Validation, Safety Assurance, Security assessment, Planning for SQA, SQA Plans, Software Testing, Specification based test construction techniques, White-box and grey-box testing, Software testing techniques for SDLC, Clean-room approach to quality assurance, Product Quality and Process Quality, Standards for process quality and standards for product quality, Walkthroughs and Inspections, Structure, Checklist, Audits, Roles and Responsibilities (Reviews, Inspections, etc), How to make Reviews and Inspections most effective

Recommended Books:

1. *"Software Quality Assurance: Principles and Practice"*, Nina S: Godbole, Alpha Science International, 2nd Edition, 2004.
2. *"Software Quality Engineering: Testing, Quality Assurance, and Quantifiable Improvement"*, Jeff Tian, Wiley-IEEE Computer Society Press, 2005.

SE-306 SOFTWARE PROJECT MANAGEMENT

Credit Hours: 3

Software Crisis and Software Engineering, Classic Mistakes, Overview of Project Management, PMI Process Groups, Software project Phases, Project charter, Statement of Work (SOW),

Planning Phase: Development lifecycle models, matching lifecycles to projects, Project plans, Work Breakdown Structures (WBS), Estimation of effort and cost (Expert Judgment, FP and Use Case point methods), Scheduling: Project network diagram fundamentals, CPM, PERT, Gantt charts, Critical chain scheduling, Using MS-Project/PrimaVera Project Planner, Assigning Resources, Resource leveling, Team models, Managing conflict and motivating, Project Monitoring and Control: Status reporting, Project metrics, Communications Techniques, Risk management and Change control Project Recovery, Documentation, Cutover/Migration, Post Project Reviews, Closing.

Recommended Books:

1. *"Software Project Management"*, Bob Hughes and Mike Cotterell , McGraw-Hill Higher Education, 4th Edition, 2005.
2. *"The Software Project Manager's Handbook - Principles that work at work"*, Dwayne Phillips, Wiley-IEEE Computer Society Press, 2nd Edition, 2004.

SE-307 E-COMMERCE **Credit Hours: 4**

Introducing E-Commerce: E-Commerce and E-Business Overview; Internet History and E-Commerce Development; Business-to-Business E-Commerce; Business-to-Consumer E-Commerce; E-Commerce Stages and Processes; E-Commerce Challenges and Opportunities

Internet Hardware, Software and Communication

Hardware - Servers, Communications Media, Storage Area Networks (SANs). Connecting to the Internet - DSL, Broadband, ISDN, T-1 and T-3 Lines. Software - Application Service Providers (ASPs), Databases.
Operating Systems - UNIX, Microsoft Windows, Linux, Mac OS X.
Enhancing Business Communication - Intranets and Extranets, Streaming Audio and Video, Internet Telephony, Web Casting and Web Conferencing.

E-Commerce Technologies

Generic trade cycles.
Electronic Markets- Electronic markets, the trade cycle Advantages and Disadvantages. Electronic Data Interchange - EDI trade cycle, Benefits of EDI, EDI standards, EDI communications, EDI implementation, EDI privacy and security, EDI and business, EDI trading patterns.
Internet Commerce.

E-Commerce with Business Perspective

The Value Chain - The supply chain, e-commerce in the value chain.
Competitive advantage - IT and competitive advantage, IT and competitive advantage cases.
Business strategy - Corporate strategy, Strategy formulation, Business environment, e-Commerce implementation, e-Commerce facilities for business.

Inter-Organisational Ttransactions - Inter-organisational transactions. Credit transaction trade cycle, variety of transactions, Inter-organizational e-Commerce.
Consumer Trade Transactions - Internet e-Commerce, the e-Shop, Internet Shopping, the Trade Cycle e-Commerce sales.

The Elements of E-Commerce
E-Visibility - Site Name, Conventional Advertising, Portals, Malls, Search Engines.
E-Shop - Online information, customer registration, site navigation, product database Order Processing.
Online Payment - Credit Cards, e-Cash and other.
Security - encryption, SSL, digital signatures.
Delivery System - E-fulfillment.
After-Sales Services.

Internet Marketing: Online and Offline Market Refresh; Data Collection; Domain Names; Advertising Option; E-Mail Marketing; Search Engines; Web-Site Monitoring.

Online Monetary Transaction: Electronic Payment Issues; E-Cash; E-Wallets; Credit Card Issues; Merchant Accounts; Online Payment Services; Transaction Processing; Taxation Issues; Developing Payment Standards

Internet Security: Security Issues and Threats; Security Procedures; Encryption; Digital Certificates; Digital Signature; Security Protocol - SSL and SET Technologies; Authentication and Identification; Security Providers; Privacy Policies; Legal Issues.

Customer Service: Customer Service Issues; Frequently Asked Question (FAQ) Pages; E-Mail Support; Telephone Support; Live Help Service; Customer Discussion Forums; Value-Added Options.

Legal, Social and Global Issues
Legal Issues - Privacy on the Internet, Tracking Devices, Employer and Employee, Protecting your Business, Intellectual Property: Patents and Copyright, Trademark and Domain Name Registration, Children and the Internet.
Social Issues - Online Communities, Online Activism, Disabilities and the Web.
Global Issues - Intent Taxation, Creating an e-Business with Global Capabilities.

Recommended Books:

1. *"e-Business and e-Commerce How to Program"*, Harvey M. Deitel, Paul J. Deitel and Tem R. Neito, Prentice Hall, 2000.
2. *"The Complete E-Commerce Book"*, Janice Reynolds, CMP Books, 2nd Edition, 2004.

CT-361 ARTIFICIAL INTELLIGENCE & EXPERT SYSTEMS Credit Hours: 4

Introduction to Artificial Intelligence, Branches of A.I. Application of A.I. knowledge, types of knowledge, acquisition of knowledge, Knowledge engineering. Problem representation and problem solving strategic, state spaces, searching techniques. Blind search techniques. Informed search techniques. Knowledge representation techniques. Frames, Scripts, Semantic networks. Implementation of knowledge representation using PROLOG. Fundamental of Expert System. Component of Expert System Developments, Cycle of Expert System. Case studies Elize, Mycin. Natural language processing, Speech processing, Introduction to Robotics, Computer vision, Neural Networks, and Machine learning.

Recommended Books:

1. "*Artificial Intelligence: Structures and Strategies for Complex Problem Solving*", George F. Lugar, Addison Wesley, 5th Edition, 2004.
2. "*Artificial Intelligence: A Modern Approach*", Stuart Russel and Peter Norvig, Prentice Hall, 3rd Edition, 2009.

CS-351 COMPUTER COMMUNICATION NETWORKS Credit Hours: 4

Introduction to Networking. Networks ISO/OSI reference Model. Performance Models of communication Networks. Design Protocols, Virtual circuit/ datagram. Routing cogestion control. Flow control local Networks satellite protocols, Broadcast Networks.

Recommended Books:

1. "*Computer Networks*", Andrew S. Tanenbaum and David J. Wetherall, Prentice Hall, 5th Edition, 2010.

MT-330 APPLIED PROBABILITY & STATISTICS Credit Hours: 3

Basic concepts of statistics; Sample space, events, classical and axiomatic definition of probability; Conditional probability and Bayes theorem; Binomial, Poisson and Normal distributions; Moment generating functions; Central limit theorem; Sampling theory; Estimation methods; Points and interval estimations; Estimating proportions and difference of two proportions; Test of hypothesis; Type I and II errors; One and two tails tests; Linear regression Correlation and regression analysis.

Recommended Books:

1. "*Probability & Statistics for Engineers and Scientists*", Ronald E. Walpole and Raymond H. Myers, Sharon L. Myers and Keying Ye, Prentice Hall, 8th Edition, 2006.
2. "*Applied Statistics & Probability for Engineers*", Douglas C. Montgomery, 4th Edition, 2006.

IF-301 APPLIED ECONOMICS FOR ENGINEERS **Credit Hours: 3**

Programming aspects, economic aspects, human relations aspects, software trends: cost, social impact, the plurality of SE Means, The GOALS Approach to Software Engineering, The Software Work Breakdown Structure (WBS), Software Maintenance, definitions and assumptions, development effort and schedule, phase distribution, The Rayleigh Distribution, interpolation, basic software maintenance effort estimation. Performance Models, Optimal Performance, Sensitivity Analysis, Cost-Effectiveness Models.

Recommended Books:

1. *"Software Engineering Economics"*, Barry W. Boehm, Prentice Hall, 1981.
2. *"Making the Software Business Case: Improvement by the Numbers"*, Donald J. Reifer, Addison Wesley Professional, 1st Edition, 2001.

FINAL YEAR

SE-401 MODELING AND SIMULATION **Credit Hours: 4**

Performance Modeling and Evaluation, Bench Marking, Performance Evaluation of High Parallel Systems Architecture. Application of Performance Evaluation.

Measurement Techniques, Hardware Monitoring, Software Monitoring, Hybrid Monitoring

Fundamentals of Queuing Models.

Structure and performance parameters. Operational Analysis of Queuing Models. General features of Queuing Models. Birth and Death process M/M/1 and M/G/1 systems. Dependability Modeling.

Analysis of Reliable, Available and High Assurance systems. Fault-tolerant Techniques. Software Reliability Modeling.

Petri Net-Based Performance Modeling. Classical Petri Nets. Discrete, Timed Petri Nets. Generalised Stochastic Petri Nets. Modeling of multiprocessors systems.

Recommended Books:

1. *"Theory of Modeling and Simulation"*, Bernard P. Ziegler, Herbert Praehofer and Tag Gon Kim,Academic Press, 2nd Edition, 2000.
2. *"A First Course in Mathematical Modeling"*, Frank R. Giordano, Cengage/Brooks Publishing, 3rd Edition, 2003.
3. *"Simulation Modeling and Analysis"*, A. M. Law and W. D. Kelton,

4. *"Mathematical Modeling and Simulation: An Introduction for Scientists and Engineers"*, Kai Velten, Wiley-VCH, 2009.
5. *"Distributed Simulation"*, John A. Hamilton, David A. Nash and Udo W. Pooch, CRC Press, 1st Edition, 1997.

SE-402 DISTRIBUTED DATABASE CLIENT SERVER PROGRAMMING **Credit Hours: 4**

Advantages and disadvantages of Distributed Database (DDB); Database Security Issue; Design Approach of DDB; Internet Addressing, Low-level Communication using UDP; Connecting to Server using TCP; Connecting to an SMTP Mail Server; Connecting to an HTTP Web Server; WWW support via Class URL; Writing Server Programs using Server Socket.

Recommended Books:

1. *"Principles of Distributed Database Systems"*, M. Tamer Ozsu, Brooks/Cole Cengage Learning, 3rd Edition, 2003.
2. *"Distributed Database Manaement Systems: A Practical Approach"*, Saeed K. Rahimi and Frank S. Haug, Wiley- IEEE Computer Society, 2010.

SE-403 DATA WAREHOUSE METHODS **Credit Hours: 4**

Introducing the Data warehouse; The Data warehouse Methods; Quality Data warehouse process; Data warehouse Methodology; Data warehouse Administration; Performance Management, Managing the Data warehouse, Data warehouse Project Management; Data Handling: Distribution and Transformation; Data Integration and Data Semantics; Data Warehouse Architecture; Meta data, Types of Meta data, control change control in the Data warehouse

Recommended Books:

1. *"Data Warehousing Fundamentals"*, M. Tamer Ozsu, Brooks/Cole Cengage Learning, 3rd Edition, 2003.
2. *"Data Mining Concepts and Techniques"*, Jiawei Han, Micheline Kamber and Jian Pei, Morgan Kaufman Publishers, 2nd Edition, 2005.

SE-404 DESIGN PATTERNS **Credit Hours: 4**

Introduction to Object-Oriented Software Development, The Object-Oriented Paradigm, UML-The Unified Modeling Language, Introduction to Design Patterns, The Facade Pattern, The Adapter Pattern, The Strategy Pattern, The Bridge Pattern, The Abstract Factory Pattern, Thinking in Patterns, The Principles and Strategies of Design Patterns, Commonality and Variability

Analysis, The Analysis Matrix, The Decorator Pattern, The Observer Pattern, The Template Method Pattern, The Factory Method Pattern.

Recommended Books:

1. *"Design Patterns Explained: A New Perspective on Object-Oriented Design"*, and , Addison-Wesley Professional, 2nd Edition, 2004.
2. *"The Timeless Way of Building"*, Christopher Alexander, Oxford Books, 1979.

   "Design Patterns in C#", Steven J. Metsker, Addison-Wesley Professional, 2nd Edition, 2004.

SE-499 SOFTWARE ENGINEERING PROJECT **Credit Hours: 6**

Market oriented Software Engineering Project, spread over two semesters.

CT-221 FINANCIAL & COST ACCOUNTING **Credit Hours: 3**

Structure of accounting, classification of accounting frameworks, Accounting principles, Accounting Cycle, Preparation and use of worksheet, the concept and procedures of adjusting, reversing and closing entries, preparation and analysis of classified and incorporated financial statements.

Basic concepts of Cost Accounting, types of cost, cost assignments, costing methods, budgeting and planning, standard cost and variance analysis. Job order costing, process costing, ABC and JIT techniques, material, labour and overhead costing.

Recommended Books:

1. *"Accounting: The Basis for Business Decisions"*, Robert Meigs and Mary Meigs, McGraw-Hill Co., 10th Edition, 1996.
2. *"Fundamentals of Cost Accounting"*, William N. Lanen, Shanon W. Anderson and Michael Maher, McGraw-Hill/Irwin, 3rd Edition, 2010.
3. *"Cost Accounting: Planning and control"*, Adolph Matz and Milton F. Usry, Wadsworth Publishing Co. Inc., 9th Revised Edition, 1989.

CT-460 NETWORK & INFORMATION SECURITY **Credit Hours: 4**

Introduction to simple Cryptosystems and their Cryptanalysis

Shift, Substitution, Affine, Vigenere, Hill, Permutation and stream ciphers.

Shannon's Theory
Elementary Probability theory, entropy, perfect secrecy, unicity distance.

Block Ciphers and Advance Encryption Standard
Chaining; Substitution-permutation networks, Feistel networks; Linear cryptanalysis of an SPN.

Cryptographic hash functions
Security requirements, collisions; Security uses: passwards, message and data integrity, notaries; MD5, SHA; Message authentication codes; Birthday attack.

The RSA Cryptosystems
Primes, GCDs and the Extended Euclidean Algorithm, modular exponentiation and inverses, Euler totient function, Euler's theorem, Introduction to public-key cryptography; RAS: basic implementation details.

Digital signature schemes
ElGamal, DSA; Elliptic Curve DSA; One-time Signatures, Undeniable Signatures Zero-Knowledge proofs, Bit communication; Pseudorandom number generation.

Network communication concepts.
Network overview, specific networking protocols, transmission media and networking hardware.

Optimizing and fine tuning for performance
Ways to speed up an existing server, Stress testing techniques. Threat of computer crimes.

Network security issues
Techniques to increase security, Internet related security issues.

Trouble shooting and preventive maintenance
Basic element of troubleshooting, hardware troubleshooting tools, Software troubleshooting tools, Diagnosing real world problems, Troubleshooting the physical network, Troubleshooting WANS.

Recommended Books:

1. "*Cryptography Theory & Practice*", Douglas R. Stinson, Chapman & Hall/CRC, 2nd Edition, 2002.
2. "*Network Security Fundamentals*", Peter Norton and Mike Stockman, Sams, 1st Edition, 1999.
3. *"Network Security: A Beginners Guide"*, Eric Maiwald, McGraw-Hill Osbourne, 2nd Edition, 2003.
4. *"Network Security Bible"*, Eric Cole, John Wiley & Sons, 2nd Edition, 2009.

MT-471 APPLIED NUMERICAL METHODS **Credit Hours: 3**

Error Analysis: Types of errors (relative, absolute, inherent, round off, truncation), significant digits and numerical instability, flow chart. Use of any Computational tools to Analyse the Numerical problems.

Linear Operators: Functions of operators, difference operators and the derivative operators, identities.

Difference Equations: Linear homogeneous and non homogeneous difference equations.

Solution of Non-Linear Equation: Numerical methods for finding the roots of transcendental and polynomial equations (Secant, Newton-Raphson Chebyshev and Graeffe's root squaring methods), rate of convergence and stability of an iterative method.

Solution of Linear Equation: Numerical methods for finding the solutions of system of linear equations (Gauss- Elimination, Gauss-Jordan Elimination, triangularization, Cholesky, Jacobi and Gauss – Seidel).

Interpolation & Curve Fitting: Lagrange's, Newton, Hermit, Spline, least squares approximation (linear and non-linear curves).

Numerical Integration & Differentiation: Computation of integrals using simple Trapezoidal Rule 1/3rd, Simpson's Rule 3/8th, Simpson's rule, Composite Simpson's and Trapezoidal Rules, computation of solutions of differential equations using (Euler method, Euler modified method, Runge Kutta Method of order 4).

Linear Programming: Formulating problems, linear programming models, graphical methods, simplex method.

Improper Integrals: Definitions, types of improper integrals and their convergence.

Elliptic Integrals: Introduction and identification of elementary elliptic integrals of first, second and third kinds, Simple applications.

Recommended Books:

1. *"Applied Numerical Analysis"*, Curtis F. Gerald and Patrick O. Wheatley, Pearson Education, 7th Edition, 2003.
2. *"Numerical Methods for Engineers"*, Steven C. Chapra and Raymond P. Canale, McGraw-Hill Higher Education, 6th Edition, 2010.
3. *"Advanced Engineering Mathematics"*, Erwin Kreyszig, John Wiley & Sons, 9th Edition, 2005.

HS-403 ENTREPRENEURSHIP

Credit Hours: 3

Understanding the Entrepreneurship Mind-Set: The Revolutionary Impact of Entrepreneurship, The Individual Entrepreneurship Mind-Set, Corporate Entrepreneurship Mind-Set, The Social and Ethical Perspectives of Entrepreneurship, Launching Entrepreneurial Ventures: Creativity and Innovation, Methods to Initiate Ventures, Legal Challenges in Entrepreneurship, The Search for Entrepreneurship Capital, Formulation of Entrepreneurial Plan: The Assessment Function with Opportunities, The Marketing Aspects of New Ventures, Financial Statements in New Ventures, Business Plan preparation for New Ventures, Strategic Perspectives in Entrepreneurship: Strategic Growth in Entrepreneurship, Valuation Challenge in Entrepreneurship, Final Harvest of a New Venture

Recommended Book:

1. *"Introduction to Entrepreneurship"*, Donald F. Kuratko, South Western College, 8th Edition, 2009.
2. *"The Entrepreneurial Mindset"*, Rita G. McGrath and Ian C. MacMillan, Harvard Business School Press, 2000.
3. *"Startup: A Silicon Valley Adventure"*, Jerry Kaplan, Replica Books, 2001.
4. *"A Good Hard Kick in the Ass: Basic Training for Entrepreneurs"*, Rob Adams, Crown Business, 2002.
5. *"Technology Ventures: From Ideas to Enterprise"*, Thomas H. Byers, Richard C. Dorf and Andrew J. Nelson, McGraw-Hill, 3rd Edition, 2010.

ELECTIVE COURSES

Choice of one of the following three courses: SE-481, SE-482 or SE-483.

SE-481 SOFTWARE TESTING STRATEGIES & TECHNIQUES Credit Hours: 4

Introduction and overview: Testing and inspection concepts, Testing categories, Inception process: Objective of formal inspection Organizing Test cases: Decision Tables, Black box and white box testing Unit testing, Integration testing, Regression testing, System testing, user acceptance testing, Metrics and complexity, State based testing, Syntax testing; Use of software testing tools.

Recommended Books:

1. *"Introduction to Software Testing"*, Paul Ammann and Jeff Offutt, Cambridge University Press, 2008.
2. *"Software Testing"*, Ron Patton, Sams Publishing, 2nd Edition, 2005.

SE-482 SOFTWARE RELIABILITY ENGINEERING & SAFETY CRITICAL SYSTEMS **Credit Hours: 4**

Introduction, Key Concepts, Definition, Reliability related costs, Software failure mechanisms, The bathtub curve for software reliability, Available tools, techniques, and metrics Software reliability Models, Software reliability metrics, Software reliability improvement techniques, Concepts of Reliability Engineering, Analysis, Prediction, Analyses etc Reliability, Availability, Maintainability and Safety (RAMS)

Recommended Books:

1. *"Software Safety and Reliability: Techniques, Approaches, and Standards of Key Industrial Sectors"*, Debra S. Herrmann, Wiley-IEEE Computer Society, 1st Edition, 2000
2. *"Reliability, Quality and Safety of Software-Intensive Systems"*, Dimitris Gritzalis, Chapman & Hall, 1997.
3. *"System Software Reliability"*, Hoang Pham, Springer-Verlag, 2006
4. *"Software Reliability Engineering"*, John D. Musa, McGraw-Hill, 2nd Edition, 2005

SE-483 INFORMATION SYSTEMS ENGINEERING **Credit Hours: 4**

History and development of information systems. The key elements and processes required for designing, analyzing, developing, and integrating complex information systems. The systems engineering approach with specific emphasis on design, development, and deployment. Requirements engineering, architecture development, security engineering, cost-benefit analysis, information and networking technologies, and operations. How information systems are engineered in today's environment through the analysis of the underlying processes of information systems engineering. Real world examples of successes and failures in information systems engineering. Broad range of technology thatÊis used today for information systems.

Recommended Books:

1. *"Service Systems Management and Engineering: Creating Strategic Differentiation and Operational Excellence"*, Ching M. Chang, John Wiley & Sons, 2010.
2. *"Managing and Using Information Systems: A Strategic Approach"*, Keri E. Pearlson and Carol S. Saunders, John Wiley & Sons, 4th Edition, 2009.