

DEPARTMENT OF COMPUTER SCIENCE & INFORMATION TECHNOLOGY

SYLLABI OF COURSES

FOR

**BACHELOR OF
COMPUTER SCIENCE AND INFORMATION TECHNOLOGY**

BATCH: 2012-2013 Onward

**NED UNIVERSITY OF ENGINEERING & TECHNOLOGY,
KARACHI-75270, PAKISTAN**

BACHELOR OF COMPUTER SCIENCE & INFORMATION TECHNOLOGY SCHEME OF STUDIES

Subject to changes and modifications by the University, the courses of studies for the present batch are as follows:

FIRST YEAR – Spring Semester

S. No.	Course Code	Title	Credit Hours
1	CT - 153	Programming Languages	3
2	CT - 158	Fundamentals of Information Technology	2
3	CT - 161	Computing Lab	2
4	MT - 171	Differential & Integral Calculus	3
5	PH - 121	Applied Physics	4
6	HS - 205 HS - 209	Islamic Studies OR Ethical Behaviour	2

FIRST YEAR – Fall Semester

S. No.	Course Code	Title	Credit Hours
1	CT - 157	Data Structure Algorithms & Applications	4
2	CT - 162	Discrete Structures	3
3	EE - 115	Electrical Technology Fundamentals	4
4	EL - 134	Basic Electronics	4
5	HS - 102	English	3
6	HS - 105 HS - 127	Pakistan Studies OR Pakistan Studies (for Foreigners)	2

SECOND YEAR – Spring Semester

S. No.	Course Code	Title	Credit Hours
1	CS - 251	Logic Design & Switching Theory	4
2	CT - 221	Financial & Cost Accounting	3
3	CT - 251	Object Oriented Programming	4
4	CT - 255	Assembly Language Programming	4
5	EL - 238	Digital Electronics	4
6	MT - 271	Ordinary Differential Equations & Complex Variables	3

SECOND YEAR – Fall Semester

S. No.	Course Code	Title	Credit Hours
1	CS - 252	Computer Architecture & Organization	4
2	CT - 254	System Analysis & Design	4
3	CT - 257	Database Management Systems	4
4	CT - 362	Web Engineering	4
5	HS - 208	Business Communications & Ethics	3
6	MT - 272	Linear Algebra & Geometry	3

THIRD YEAR – Spring Semester

S. No.	Course Code	Title	Credit Hours
1	CS - 352	Digital Communication Systems	4
2	CS - 353	Microprocessors & Their Applications	4
3	CT - 352	Computer Graphics	4
4	CT - 353	Operating Systems	4
5	MT - 330	Applied Probability & Statistics	4

THIRD YEAR – Fall Semester

S. No.	Course Code	Title	Credit Hours
1	CS - 351	Computer Communication Networks	4
2	CT - 354	Software Engineering	4
3	CT - 360	Visual Programming	4
4	CT - 361	Artificial Intelligence & Expert Systems	4
5	CT - 461	E-Commerce	4

FINAL YEAR – Spring Semester

S. No.	Course Code	Title	Credit Hours
1	CT - 452	Modeling & Simulation	4
2	CT - 455	Distributed Database Client Server Programming	4
3	CT - 456	Data Warehouse Methods	4
4	CT - 460	Network & Information Security	4
5	MT - 471	Applied Numerical Methods	4
6	CT - 499	*Software Based Project	-

* Duration one academic year: Literature survey and preliminary work to be done during this Semester.

FINAL YEAR – Fall Semester

S. No.	Course Code	Title	Credit Hours
1	CS - 451	Parallel Processing	4
2	CT - 454	Compiler Design	3
3	CT - ###	Elective Course	4
4	CT - 499	Software Based Project	6
		Elective Courses: CT - 481 Wireless Network & Mobile Computing CT - 482 Bio-Informatics CT - 483 System Administration	

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, Information Systems and MIS, Networks & Internet concepts.

Recommended Books:

1. *"Introduction to 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-161 COMPUTING LAB**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.

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.

EE-115 ELECTRICAL TECHNOLOGY FUNDAMENTALS**Credit Hours: 4**

Energy and energy transfer, Electric Charge, Electric Current, Potential Difference and Voltage, Electrical Power and Energy, Electric circuits sources and elements, resistance, Ohm’s law,

Inductance, Capacitance, Kirchoff's Laws, Thevenin and Norton Equivalents, Superposition, Node voltage and loop current methods.

Steady State AC and DC Analysis: An introduction to Periodic functions, RMS or effective, Average and Maximum values of current and voltage for sinusoidal signal waveforms. Introduction to phasor method of Analysis, Simple AC and DC circuits, Real and Reactive power, Power factor, Maximum power transfer condition.

Magnetic Circuits and Transformers: Magnetic effects of electric current, Magnetic circuits concepts, Magnetic circuits with DC excitation, Magnetically induced voltage, LR and LC circuits with sinusoidal excitation, Introduction to transformer and related concepts, voltage and current relation. Introduction to AC motors.

Electrical Measurements and Instruments:

- i. Introduction to Analog and Digital Multimeters and Frequency Counters.
- ii. Measurement of AC/DC voltage and current using Analog and Digital meters.
- iii. Measurement of Frequency using Frequency counters.

Recommended Books:

1. "*Fundamentals of Electric Circuits*", Charles K. Alexander and Mathew Sadiku, McGraw Hill Science/Engineering/Math, 4th Edition, 2008.
2. "*Hughes Electrical Technology*", Edward Hughes and Ian McKenzie Smith, Addison Wesley Longman, 7th Sub Edition, 1995.

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 and Full wave rectification, smoothing capacitor and filters, Ripple, Regulation and Regulated Power Supplies.

Bipolar and 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 and 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.

MT-171 DIFFERENTIAL AND INTEGRAL CALCULUS

Credit Hours: 3

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, Functions 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*”, George B. Thomas and Ross L. Finney, 9th Edition, Addison Wesley Longman, 2002.
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.

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. Pakistani 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.

HS-205 ISLAMIC STUDIES

Credit Hours: 2

Thematic 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-Nahl – 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-Nahl - 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-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.

SECOND YEAR

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.

Includes a practical component of 1 Credit Hour.

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-251 OBJECT ORIENTED PROGRAMMING

Credit Hours: 4

What is an Object, Benefits of OOP; Object Oriented Environment; Class Object; Approach to Object Oriented Programming (from C to C++); Constructor; Destructor; Program Style; Functions; Inheritance, I/O streams, Overloading operations, Programming Examples.

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.

CT-254 SYSTEM ANALYSIS & DESIGN**Credit Hours: 4**

Study of conventional and structured techniques, Objectives, investigations, system models, etc. Physical models; Data models; Project dictionary. System design and implementation; tools and techniques; Prototyping; Preparation and handling of data, File organization design, documentation; Implementation and evaluation of information systems, Problems of systems analysis and design; Project management tools and techniques: A case study as assignment.

Recommended Books:

1. “*Modern Systems Analysis & Design*”, Jeffrey A. Hoffer, Joey F. George and Joseph S. Valacich, Prentice Hall, 5th edition, 2007.
2. “*Systems Analysis & Design*”, Allan Dennis, Barbara H. Wixom and Roberta M. Roth, Wiley, 4th Edition, 2008.

CT-255 ASSEMBLY LANGUAGE PROGRAMMING**Credit Hours: 4**

Digital computer organization, machine language, instruction execution, addressing techniques, digital representation of data, symbolic coding and assembly systems; Macros; I/O control; subroutine linkage: System and utility programs, programming techniques; Facilities of operating system; Large number of programming assignments on 80x86 based personal computers.

Recommended Books:

1. “*Assembly Language Programming and Organization of IBM PC*”, Ytha Yu, 1st Edition, McGraw Hill, 1992.
2. “*Assembly Language for Intel Based Computers*”, Kip Irvine, 5th Edition, Prentice Hall, 2006.

CT-257 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. “*An Introduction to Database Systems*”, C. J. Date, Addison Wesley, 8th Edition, 2003.

CT-362 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 HTTP 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 Timeline.

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 & ORGANIZATION

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.

EL-238 DIGITAL ELECTRONICS

Credit Hours: 4

RTL and DTL circuits, Transistor-Transistor logic, Integrated Injection Logic, MOS & CMOS, Fan-in and Fan-out, Open-collector TTL, gates, three-states, TTL gates, Schottky TTL and Emitter coupled logic, Combinational Logic, Combinational Circuit Design, Analog-to-Digital and Digital-to-Analog conversion.

Recommended Books:

1. “*Micro Electronics Circuits*”, Adel S. Sedra and Kenneth C. Smith, Oxford University Press, USA, 6th Edition, 2009.
2. “*Electronic Devices*”, Thomas L. Floyd, Prentice Hall, 8th Edition, 2007.

MT-271 ORDINARY DIFFERENTIAL EQUATIONS & COMPLEX VARIABLE Credit Hours: 3

Ordinary Differential Equation: Definitions (differential equation, general solution, particular solution, initial condition, boundary condition, initial homogenous and non-homogenous and non-homogenous differential equations), First order & first degree D.E., solution of non-homogenous linear differential equations with constant coefficients, solution of Euler differential equation, computation of particular integral of non-homogenous differential equations with model problems.

Partial Differential Equation: 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 multipliers.

The Laplace Transforms: Definitions of Laplace Transforms: Motivation and Examples; Properties and Important Theorems of Laplace Transforms: Computations of Laplace Transforms of Important Functions; Inverse Laplace Transforms and Their Properties; Applications of Laplace Transforms to ODEs.

Infinite Series: Application of convergence tests such as comparison, Root, Ratio, Raabe’s and Gauss tests on the behavior of series.

Fourier Series: Introduction to Fourier series, Euler Fourier formulae, even and odd functions, application of Fourier series, Fourier transform and fast Fourier transform and properties with applications.

Complex Variable: Limit, continuity, zeros and poles of a complex function. Cauchy-Reimann equations, conformal transformation, contour integration.

Recommended Books:

1. “*Advanced Engineering Mathematics*”, Erwin Kreyszig, John Wiley & Sons, 9th Edition, 2006.
2. “*Differential Equations with Boundary Value Problems*”, Dennis G. Zill and Michael R. Cullen, Thomson Brooks/Cole Publishing, 7th Edition, 2009.
3. “*Differential Equations: A modeling Perspective*”, Robert L. Borelli and Courtney S. Coleman, Wiley, 2nd Edition, 2004.

MT-272 LINEAR ALGEBRA & GEOMETRY

Credit Hours: 3

Linear Algebra: Linearity and linear dependence of vectors, basis, dimension of a vector space, field matrix and type of matrices (singular, non-singular, symmetric, non-symmetric, upper, lower, diagonal tri-diagonal 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.

Euclidean Spaces and Transformation: Geometric representation of vector, norm of vector, Euclidean inner product, projections and orthogonal projections, Euclidean n spaces n properties Cauchy-Schwarz inequality, Euclidean transformations apply geometric transformations to plane figure, composition of transformations.

Application of Linear Algebra: Leontief Economic models, Electrical Networks, Scaling, translation, rotation, and projection.

Eigen Values & Eigen Spaces: Interpret eigen vectors and eigen values of a matrix in terms of transformation it represents, convert a transformation into a matrix eigen value problem, find the eigen values and eigen vectors of order not more than 3x3 matrices algebraically, determine the modal matrix for a given matrix, reduce a matrix to diagonal form and Jordan form, state the Cayley-Hamilton theorem and use it to find powers and the inverse of a matrix, use appropriate software to compute the eigen values and eigen vectors of a matrix, Define quadratic form and determine its nature using eigen values.

Solid Geometry: Coordinate Systems in three dimensions. Direction cosines and ratios, vector equation of a straight line, plane and sphere, curve tracing of a function of two and three variables, Surfaces of revolutions, Transformations (Cartesian to polar)

Recommended Books:

1. “*Elementary Linear Algebra: Applications Version*”, Howard Anton and Chris Rorres, John Wiley & Sons Wiley, 10th Edition, 2010.
2. “*Advanced Engineering Mathematics*”, Erwin Kreyszig, John Wiley & Sons, 9th Edition, 2006.

3. “*Elementary Linear Algebra with Applications*”, Bernard Kolman and David Hill, Prentice Hall, 9th Edition, 2007.
4. “*Calculus with Analytic Geometry*”, Howard Anton, John Wiley & Sons, 5th Edition, 1995.

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.

THIRD YEAR

CT-352 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.

CT-353 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.

CT-354 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 and 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.

CT-360 VISUAL PROGRAMMING

Credit Hours: 4

Introduction to Windows programming, Use of Windows API, MFC Class hierarchy, Class wizard, Application wizard and Application Studio, Graphics Device Interface, Menus, document view architecture, Multiple Views, files and archiving mechanisms, converting windows programmes to MFC, Sub-classing controls.

Recommended Books:

1. “*Professional C# 2008*”, Christian Nagel, Bill Evjen, Jay Glynn, Morgan Skinner and Karli Watson, Wrox, 2008.
2. “*C# 3.0: The Complete Reference*”, Herbert Schildt, McGraw-Hill Osborne Media, 3rd Edition, 2008.

CT-361 ARTIFICIAL INTELLIGENCE & EXPERT SYSTEMS

Credit Hours: 4

Introduction to Artificial Intelligence, Branches of AI Application of AI 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. Luger, Addison Wesley, 5 Edition, 2004.
2. “*Artificial Intelligence: A Modern Approach*”, Stuart Russel and Peter Norvig, Prentice Hall, 3rd Edition, 2009.

CT-461 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 Transactions - 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.

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 congestion 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.

CS-352 DIGITAL COMMUNICATION SYSTEMS

Credit Hours: 4

Elements of Modern Digital Communications. Channels, Fundamentals Limitations, Electromagnetic spectrum.

Signal Analysis: Classification, representation of signals. Fourier transform Theory. Baseband systems, filtering, random signal analysis. Probability models of random process.

Analog communication systems. Sampling Theory, Pulse code modulation, time division multiplexing Satellite communication.

Digital communication, Baseband digital transmission. Digital modulation techniques. Data communications. Computer Networks.

Error-control and Coding.

Error correction and detection techniques. Hamming code and Huffman encoding. Linear Block Encoding.

Information Theory.

Entropy, channel capacity. Discrete channels. Hartely Shannon's Law.

Recommended Books:

1. "*Communication Systems*", Simon Haykin, Wiley, 5th Edition, 2009.
2. "*Digital & Analog Communication Systems*", Leon W. Couch, Prentice Hall, 7th Edition, 2006.

CS-353 MICROPROCESSORS & THEIR APPLICATIONS

Credit Hours: 4

MPU Architecture and Instrumentation Set: Introduction, MPU Architecture, Control Signals Instruction set.

The Instruction Set: Introduction, Instruction set coding schemes, Addressing Modes, Various Institution Groups.

System Capabilities: Interrupt Structure Pooling, Vectoring, Memory Mapped and Isolated I/O, Interrupt Handling and Considerations in the implementation of interrupts Address Decoding DMA & DMA chips, Parallel & Serial I/O.

Interfacing: Programmable Parallel Ports & Hand shake I/O D/A Converter operation. Interfacing and Application, A/D converter Specification, types and interfacing.

Application: Process control systems, Instrumentation, Robotics, DSP & Digital Filters, Introduction to current generation of Microprocessors.

Recommended Books:

1. "*Intel Microprocessors*", Bary B. Brey, Prentice Hall, 8th Edition, 2008.
2. "*The Intel Family of Microprocessors: Hardware and Software Principles and Applications*", James L. Antonakos, Delmar Cengage Learning, 1st Edition, 2006.

MT-330 APPLIED PROBABILITY & STATISTICS

Credit Hours: 4

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.

FINAL YEAR

CT-452 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.

CT-454 COMPILER DESIGN**Credit Hours: 3**

Basic Concept; Input and Lexical Analysis; Context Free Grammar; Top-Down Parsing; Bottom-Up Parsing; Code Generation; Automata theory; Optimization Strategies, Support Functions, Working Problem in Compiler Design.

Recommended Books:

1. “*Compilers: Principles, Techniques and Tools*”, Alfred V. Aho, Monica S. Lam, Ravi Sethi and Jeffrey D. Ullman, Addison Wesley, 2nd Edition, 2007.
2. “*Modern Compiler Design*”, Dick Grune, Henri E. Bal, Criel J. H. Jacobs and Koen G. Langendoen, Wiley & Sons, 2nd Edition, 2010.

CT-455 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 Management Systems: A Practical Approach*”, Saeed K. Rahimi and Frank S. Haug, Wiley- IEEE Computer Society, 2010.

CT-456 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; Metadata, Types of Metadata, 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.

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: passwords, 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

EIGamal, 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.

CT-499 SOFTWARE-BASED PROJECT**Credit Hours: 6**

Market oriented Software Project, spread over two semesters.

CS-451 PARALLEL PROCESSING**Credit Hours: 4**

Parallelism in microprocessor, Architectural classification schemes, Principles of pipelining and vector processing, Array Processors, Multiprocessor Architecture and Parallel algorithms, Introduction to Dataflow computers.

Recommended Books:

1. “*Advanced Computer Architecture: a Design Space Approach*”, Dezsó Sima, Terrence Fountain and Peter Karsuk, Pearson Education, 1st Edition, 1997.
2. “*Introduction to Parallel Computing*”, Ananth Grama, George Karpis, Vipin Kumar and Anshul Gupta, Addison Wesley, 2nd Edition, 2003.

MT-471 APPLIED NUMERICAL METHODS**Credit Hours: 4**

Error Analysis: Types of errors (relative, absolute, inherent, round off, truncation), significant digits and numerical instability, flow chart. Use 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 $\frac{1}{3}$ rd, Simpson’s Rule $\frac{3}{8}$ th, 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.

ELECTIVE COURSES

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

CT- 481 WIRELESS NETWORKS & MOBILE COMPUTING

Credit Hours: 4

- Introduction to wireless communication system
- First, second and third generation wireless networks (AMPS, IS-95, IS-136, GSM,GPRS,WCDMA, etc)
- Network layer issues and protocols-Mobile IP, addressing & routing for mobile system.
- Wireless LANs: safety, security, cost IEEE802.11 and ETSI Hyper LAN Physical layer: spread spectrum and infrared. High speed wireless LAN developments. Bluetooth technology and applications.
- Transport and Application layer protocols: WAP and beyond

- Mobile agents, architectures and configurations.
- OS for mobile devices (such as WinCE, Palm OS, Symbian, MS Smartphone....etc).
- APIs for mobile devices, (such as J2ME, .NET, MIDlets). APIs for mobile communications.
- UML design and patterns for mobile applications.
- Software architectures and middleware for mobile enabled distribution systems.
- Project management and testing strategies.
- Security and maintenance of mobile computing system.

Recommended Books:

1. “*Wireless Communication: Principles and Practice*”, Theodore S. Rappaport, Prentice Hall, 2nd Edition, 2002.
2. “*Mobile Communications*”, Jochen Schiller, Addison Wesley, 2nd Edition, 2003.

CT-482 BIO-INFORMATICS

Credit Hours: 4

Pre-requisites

Biological knowledge: Biochemistry, Molecular Biology.

Mathematical: Single Variable Calculus, Probability and Statistics.

Computing Knowledge: Basic Programming Skills (Java, SQL) Database, Windows and Unix operating systems.

Fundamentals of Bioinformatics

Aim: To provide an overview of bioinformatics (what it is, why it is needed, and what it promises to deliver).

- Information to bioinformatics.
- Biological database – developing, implementing and querying database system, mining data using SQL.
- Protein structure – 3D structure, sequence patterns and characteristics, protein structure prediction and comparison.
- Analysis of gene sequence.

Statistical methods in bioinformatics

Aim: To provide students with the mathematical knowledge and skills required to understand and implement bioinformatics algorithms.

- Revision of basic mathematics.
- Vectors and matrices.
- Multivariate statistics – particularly exploratory methods and pattern recognition.

Bioinformatics Algorithms and Tools

Aim: To introduce the most important bioinformatics software tools, and explain the algorithms that underpins them.

- Visualisation of sequence data
- Pair wise and Multiple sequence alignment.
- Homology searching – including BLAST.
- Gene expression informatics.
- Introduction to gene finding.

Applications and Commercial Aspects of Bioinformatics

Aim: to outline the current and potential applications of bioinformatics and the legal, ethical and commercial aspects of using biological data.

- Visualisation of sequenced data.
- Drug discovery.
- Genetic basis of disease.
- Personalised medicine and gene-based diagnostic.
- Legal, ethical and commercial ramification of bioinformatics.

PERL Programming

Aim: To provide students with the ability to program in PERL, the most popular programming language in the bioinformatics community.

PERL Programming for:

- Data manipulation.
- File maintenance.
- Pipelining.
- Packaging and interfacing system facilities.

Analysis of Microarray Data

Aim: Massive amounts of data are generated from Microarray data. Analytical and Statistical methods required to explore the relationship between genes and to reveal patterns of expression.

- Experimental design and normalization.
- Differential Expression, Filtering and Clustering.
- Functional Analysis and Visualisation.

Recommended Books:

1. *“Introduction to Bioinformatics”*, Arthur M. Lesk, Oxford University Press, 3rd Edition, 2008.
2. *“Bioinformatics”*, T. Charlie Hodgman, Andrew French and David R. Westhead, T & F Books, UK, 2nd Edition, 2010.

3. *“Bioinformatics for Dummies”*, John Wiley & Sons, Inc., 2007.
4. *“Bioinformatics: The Machine Learning Approach”*, Pierre Baldi and Soren Brunak, MIT Press, 2001.

CT-483 SYSTEM ADMINISTRATION

Credit Hours: 4

Course outline: A survey of the tools and techniques used in the administration of computing system, 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, and the use of advanced scripting to ease system administration tasks.

Recommended Books:

1. *“The Practice of System and Network Administration”*, Thomas S. Limoncelli, Christina J. Hogan and Strata R. Chalup, Addison Wesley, 2nd Edition, 2007.
2. *“Principles of Network and System Administration”*, Mark Burgess, John Wiley & Sons Ltd., 2nd Edition, 2004.
3. *“Handbook of Network and System Administration”*, Jan Bergstra and Mark Burgess, Elsevier, 1st Edition, 2007.