

DEPARTMENT OF COMPUTER SCIENCE & INFORMATION TECHNOLOGY

SYLLABI OF COURSES

FOR

**BACHELOR OF SCIENCE IN
COMPUTER SCIENCE**

BATCH: 2019 Onward

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

BACHELOR OF SCIENCE IN 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 - 174	Fundamentals of Information Technology	3 (2+1)
2	CT - 175	Programming Fundamentals	3 (3+1)
3	MT - 171	Differential & Integral Calculus	3 (3+0)
4	PH - 122	Applied Physics	4 (3+1)
5	HS - 205 HS - 209	Islamic Studies OR Ethical Behaviour	2 (2+0)

FIRST YEAR – Fall Semester

S. No.	Course Code	Title	Credit Hours
1	CS - 251	Logic Design & Switching Theory	4 (3+1)
2	CT - 162	Discrete Structures	3 (3+0)
3	CT - 251	Object Oriented Programming	4 (3+1)
4	HS - 104	Functional English	3 (3+0)
5	HS - 105 HS - 127	Pakistan Studies OR Pakistan Studies (for Foreigners)	2 (2+0)
6	HSK - I	Chinese Language	NC

SECOND YEAR – Spring Semester

S. No.	Course Code	Title	Credit Hours
1	CT - 157	Data Structure Algorithms & Applications	4 (3+1)
2	CT - 259	System Analysis & Design	3 (3+0)
3	MT - 227	Differential Equations	3 (3+0)
4	HS - 115	Academic Reading & Writing	3 (3+0)
5	HS - 219	Professional Ethics	2 (2+0)
6	HSK - II	Chinese Language	NC

SECOND YEAR – Fall Semester

S. No.	Course Code	Title	Credit Hours
1	CS - 252	Computer Architecture & Organization	4 (3+1)
2	CT - 257	Database Management Systems	4 (3+1)
3	CT - 258	Financial & Cost Accounting	3 (3+0)
4	HS - 218	Business Communication	3 (2+1)
5	MT - 272	Linear Algebra & Geometry	3 (3+0)

THIRD YEAR – Spring Semester

S. No.	Course Code	Title	Credit Hours
1	CT - 365	Software Engineering	3 (3+0)
2	CT - 363	Design & Analysis of Algorithms	3 (3+0)
3	CT - 353	Operating Systems	4 (3+1)
4	CT - 364	Theory of Automata & Formal Languages	3 (3+0)
5	MT - 331	Probability & Statistics	3 (3+0)

THIRD YEAR – Fall Semester

S. No.	Course Code	Title	Credit Hours
1	CS - 351	Computer Communication Networks	4 (3+1)
2	CT - 361	Artificial Intelligence & Expert Systems	4 (3+1)
3	CT - 362	Web Engineering	4 (3+1)
4	CT - 367	Theory of Programming Languages	3 (3+0)
5	MT - 442	Numerical Methods	3 (3+0)

FINAL YEAR – Spring Semester

S. No.	Course Code	Title	Credit Hours
1	CT - 460	Network & Information Security	4 (3+1)
2	CT - ###	Elective I	3 (3+0)
3	CT - ###	Elective II	4 (3+1)
4	HS-405	Organisational Behaviour	3 (3+0)
5	CT - 499	*Software Based Project	3 (0+3)

* 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 - 428	Parallel & Distributed Processing	4 (3+1)
2	CT - 465	Compiler Design	3 (3+0)
3	HS - 403	Entrepreneurship	3 (3+0)
4	CT - ###	Elective III	4 (3+1)
5	CT - 499	Software Based Project	3 (0+3)

Elective Courses

Course Code	Elective – I (3+0)
CT-366	E-Commerce
CT-485	Natural Language Processing
CT-464	Modelling & Simulation

Course Code	Elective – II, Elective - III (3+1)
CT-352	Computer Graphics
CT-360	Visual Programming
CT-462	Distributed Computing
CT-463	Data Warehousing & Mining
CT-481	Wireless Network & Mobile Computing
CT-484	Introduction to Cyber Security

FIRST YEAR

CT-162 DISCRETE STRUCTURES

Credit Hours: 3,0

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, 7th Edition, 2012.
2. *“Mathematical Structures for Computer Science”*, Judith L. Gersting, W. H. Freeman, 7th Edition, 2014.

CT-174 FUNDAMENTALS OF INFORMATION TECHNOLOGY **Credit Hours: 2,1**

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. *“Fundamentals of Information Technology”*, Anoop Mathews, Alpha Science International Limited, 2013.
2. *“Introduction of Computers”*, Peter Norton, Glencoe/McGraw-Hill, 6th Edition, 2004.

CT-175 PROGRAMMING FUNDAMENTALS

Credit Hours: 3,1

Introduction to programming languages, Different generations of Languages (1GL, 2GL, 3GL, 4GL, 5GL), Basic Programming Constructs, Introduction to problem solving, role of compiler and linker, Pre-processor Directives, introduction to algorithms, Basic data types, Variables,

(Local and Global), Constants input/output constructs, Types of Operators (Unary, Binary, Ternary), Relational Operators, Arithmetic Operators, Assignment Operators, Logical Operators, prefix and Postfix Increment and Decrement Operators, Repetition Structures, Loops (FOR, WHILE, DO WHILE), Conditional Structures (If, If-Else, Switch), Break and Continue, Introduction to Arrays, Multidimensional arrays, Functions and Procedures, Function Overloading, how to pass an array to a function (Pass by value and Pass By reference), Introduction to modular programming, string and string operations, Structures, pointers/references, static and dynamic memory allocation, File I/O operations

Recommended Books:

1. “*Python 3 Object Oriented Programming*”, Dusty Phillips, 3rd Edition, 2018, Packt Publishing.
2. “*Let us C*”, Yashavant P. Kanetkar, Jones & Bartlett Publishers, 15th Edition, 2016.
3. Paul J. Deitel and Harvey Deitel, ” *C++ How to Program*”, 10th Edition, Prentice Hall , 2017.

CT-251 OBJECT ORIENTED PROGRAMMING

Credit Hours: 3,1

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. “*C++: How to Program*”, Paul Deitel and Harvey Deitel, Pearson, 10th Edition, 2017.
2. “*The object oriented thought process*”, Matt Weisfeld, Addison Wesley, 2013.
3. “*C++ Programming: From Problem Analysis to Program Design*”, D.S. Malik, Course Technology, 5th Edition, 2010.

CS-251 LOGIC DESIGN & SWITCHING THEORY

Credit Hours: 3,1

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.

MT-171 DIFFERENTIAL AND INTEGRAL CALCULUS

Credit Hours: 3,0

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-122 APPLIED PHYSICS

Credit Hours: 3,1

Fundamentals: Kinetics, potential, vibrational and rotational energies.

Electricity and Magnetism: Charge, Ohm's Law, Direct and Alternating currents, capacitance and inductance (self and mutual inductance), Kirchoff's Laws, thermo-electricity, Seebeck and Peltier effects. Galvanometer, Ammeter and Voltmeter, Cathode-Ray Oscilloscope, Magnetic Properties (permeability and susceptibility), diamagnetism, paramagnetism and ferromagnetism. Induction coil and transformer.

Electronics: Semiconductors, P-type, N-type semiconductors, PN-diode and its characteristics, PNP and NPN transistors and their characteristics.

Optics & Laser Physics: Interference, diffraction and polarisation phenomena. Laser stimulated emission, population inversion, laser application.

Modern Physics: Atomic structure, Black body radiation, Photon, de-Broglie's Waves, photoelectric effect, Compton effect, Mass-Energy conversion relation. Nuclear structure, Radioactivity, Alpha, Beta and Gamma particles and their properties. Radio activity. Decay Theorem, Half-life X-Rays, characteristics and applications of X-Rays, Liquid-drop model, Fission and Fusion processes, Nuclear Reactor, Nuclear radiation, Hazards and safety.

Thermodynamics and Cryogenics: Heat, Temperature and internal energy, Laws of thermodynamics (Zeroth, 1st, 2nd and 3rd laws), Concept of entropy, Cryogenics, low temperature, method of production of low temperature (joule-Kelvin Effect, Adiabatic demagnetisation).

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-104 FUNCTIONAL ENGLISH

Credit Hours: 3,0

Listening: types of listening, problems in listening and coping strategies, listening skills, sub skills, practice in listening, note taking: techniques for taking notes from lectures, from books, note taking in different forms paragraphs, points, figures, processes, tables, graphs etc. vocabulary development: enhancing current vocabulary to reflect a better usage of words in spoken and written language, tips/ strategies in vocabulary enhancement, practice in vocabulary development. Reading: reading skills, sub skills, reading comprehension levels, reading strategies, reading practice through variety of reading texts and comprehension exercises, beyond reading (outline, précis, speech and presentation). Writing: process of writing, informal writing strategies, writing correctly: sentence structure and punctuation, error correction, paragraphs: structure, types, topic and the topic sentence, and unity, adequate development and coherence in paragraphs, essays: types, five paragraphs long essays, and structure (thesis statement and the paragraphs), short reports: structure, format, and types (informational and analytical), letters:

elements, style, formatting (digital letter writing), organization and structure of the letter, and types (routine requests and intimation, invitation, thank you and condolence letters etc.).

Recommended Books:

1. “Cambridge vocabulary for IELTS”, Pauline Cullen, Cambridge University Press. 2008
2. “English Vocabulary in Use (upper intermediate)”, Michael McCarthy & Felicity O’Dell Cambridge University Press. 2008.
3. “*Oxford Practice Grammar*”, John Eastwood, Oxford University Press, 2006.
4. “Academic Listening Encounters: Human Behaviour”, (Cambridge University Press), 2004
5. “Study Listening”, by Lynch(Cambridge University Press). 2nd Edition, 2007
6. “Themes for Listening and Speaking Teacher’s”, Carole Robinson and Helen Parker (Oxford University Press), 2nd Edition, 1986
7. “Making Connections: A strategic Approach to Academic Reading”, Kenneth J Pakenham (Cambridge University Press), 2nd Edition, 2004
8. “Study Reading”, Glendinning and Holmstrom.(Cambridge University Press), 2nd Edition, 2007
9. “Writing and the Writer”, Frank Smith, Heinemann Educational Books.1994
10. “Connections – A Guide to basics of writing”, Peter Dow Adams, Little Brown and Company,1987
11. “College Writing skills”, John Langan, Irwin McGraw Hill, 5th Edition, 1984
12. “The Elements of International Style: A Guide to writing correspondence, reports, Technical Documents, and internet pages for a global Audience” by Edmond H Weiss. Prentice Hall.

HS-105 PAKISTAN STUDIES

Credit Hours: 2,0

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 STUDIES

Credit Hours: 2,0

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: 2,0

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: 2,0**

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-157 DATA STRUCTURE ALGORITHMS & APPLICATIONS Credit Hours: 3,1

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. “*A Common-Sense Guide to Data Structures and Algorithms: Level Up Your Core Programming Skills*”, Jay Wengrow, Pragmatic Bookshelf, 1st Edition, 2017.
2. “*Data Structures with C*”, Seymour Lipschutz, McGraw-Hill, 2011.
3. “*Data Structures and Algorithms*”, Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, Pearson Education Inc., Fourth Impression, 2010.

CT-257 DATABASE MANAGEMENT SYSTEMS Credit Hours: 3,1

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. “*Fundamentals of Database Systems*”, Ramez Elmasri, Shamkant Navathe, Pearson, 7th Edition, 2015.
2. “*Fundamentals of Database Management Systems*”, Mark.L.Gillenson, Wiley Publisher 2nd Edition, 2011.
3. “*Database Systems*”, Thomas M. Connolly, Addison Wesley, 5th Edition, 2009.

CT-258 FINANCIAL & COST ACCOUNTING**Credit Hours: 3,0**

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-259 SYSTEM ANALYSIS & DESIGN**Credit Hours: 3,0**

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.

CS-252 COMPUTER ARCHITECTURE & ORGANIZATION**Credit Hours: 3,1**

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-227 DIFFERENTIAL EQUATIONS**Credit Hours: 3,0**

1st Order Differential Equations Basic concept; Formation of differential equations and solution of differential equations by direct integration and by separating the variables; Homogeneous equations and equations reducible to homogeneous form; Linear differential equations of the order and equations reducible to the linear form; Bernoulli's equations . Application in relevant Engineering: orthogonal trajectories: Numerical approximation to solutions ; Solution in series. Euler method, Euler modified method, Runge Kutta method of order 4.

2nd and Higher Orders Equations Special types of II nd order differential equations with constant coefficients and their solutions; The operator D; Inverse operator I/D ; Solution of differential by operator D methods; Special cases, Cauchy's differential equations; Simultaneous differential equations; simple application of differential equations in relevant Engineering.

Partial Differential Equation Basic concepts and formation of partial differential equations; Linear homogeneous partial differential equations and relations to ordinary differential equations; Solution of first order linear and special types of second and higher order differential equations; D' Alembert's solution of the wave equation and two dimensional wave equations; Lagrange's solution: Various standard forms.

Laplace Integral & Transformation Definition, Laplace transforms of some elementary functions, first translation or shifting theorem, second translation or shifting theorem, change of scale property, Laplace transform of the nth order derivative, initial and final value theorem Laplace transform of integrals. Laplace transform of functions $\ln F(t)$ and $F(t)/t$, Laplace transform of periodic function, evaluation of integrals, definition of inverse Laplace transform and inverse transforms, convolution theorem, solutions of ordinary differential using Laplace transform.

Recommended Books:

1. "Advance Engineering Mathematics", Erwin Kreyszig, Seven Edition.
2. "Differential Equation A modeling Perspective", Robert L. Barrelli, 1998.
3. "Introduction to Differential Equation", J. Farlaw 1994.
4. "Differential Equation", G. Zill.

MT-272 LINEAR ALGEBRA & GEOMETRY**Credit Hours: 3,0****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 etc.

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*”, Howard Anton, 7th Edition.
2. “*Calculus & Analytical Geometry*”, Howard Anton, 5th Edition.
3. “*Elementary Linear Algebra*”, Bernard Kolman , 7th Edition

HS-115 ACADEMIC READING & WRITING

Credit Hours: 3,0

Reading and Critical Thinking: Reading academic texts effectively, Using strategies for extracting and locating information in text and visuals; identifying main idea and purpose; separating main points from supporting details; drawing inferences and conclusions in a

text. Identifying the writer's intent (cause and effect, reasons, comparison and contrast, exemplification etc.). Interpreting charts and diagrams.

Making appropriate notes using strategies mind maps, tables, lists, graphs. Reading and carrying out instructions for tasks, assignments and examination questions. Enhance academic vocabulary using appropriate skills and strategies; and identifying pronunciation through pronunciation key.

Writing Academic Texts. Planning writing task: identifying audience, purpose and message (content). Collect information in various forms such as mind maps, tables, charts, lists. Argumentative, narrative, expository and descriptive forms of writing. Write good topic and supporting sentences and effective conclusions. Achieving unity, coherence, adequate development in writing. Use appropriate cohesive devices such as reference words and signal markers. Order & Organize information: Chronology for a narrative, listing, Stages of a process, from general to specific and vice versa, from most important to least important, advantages and disadvantages, comparison and contrast, problem solution pattern, for and against; using different methods of developing ideas like listing, comparison, and contrast, cause and effect, for and against. Revising/Redraft checking content, structure and language. Edit and proof read.

Recommended Books:

1. *“Cambridge vocabulary for IELTS”*, Pauline Cullen, Cambridge University Press, 2008.
2. *“Academic Listening Encounters: Human Behaviour”*, Miriam Espeseth, CUP, 2004.
3. *“Study Listening”*, Lynch, 2nd Ed., Cambridge University Press, 2007.
4. *“Study Reading”*, Glendining and Holmstrom, 2nd Ed., CU P, 2007.
5. *“Writing and the Writer”*, Frank Smith, Heinemann Educational Books, 1994.

HS-218 BUSINESS COMMUNICATION

Credit Hours: 2,1

Foundations of Business Communication: Definitions: communication, organization, business; understanding the need and scope of business, professional and organizational communication, Conditions, properties, process, tools, modes, levels, types of communication; Principles of Effective Communication & Building goodwill (Your attitude, positive emphasis and unbiased language); Listening, non-verbal communication. Communication dilemmas and problems; Feedback and its types; Audience Analysis. Oral Communication: Group Discussions and interpersonal skills, Meetings, Interviews, Making presentations. Business & Technical Writing: Types of messages: Formats (Letter and memorandum); Letter and memorandum elements and formats. Three Types of Business Messages (routine, negative and persuasive communications). Organizational Plans: Direct, Indirect & AIDA approach; Writing business messages (e-mails, inquiries, requests, replies, regrets, declining offers, letters, routine messages, etc.); Meetings: notice, agenda and minutes. Job applications and resumes. Research/scientific reports (structure, layout, writing process)

Recommended Books:

1. *“Business and Professional Communication”*, Roach, Gant & Allyn Perrigo & Bacon, Sage Publications, 2014.

2. “ *Essentials of Business Communication*”, Guffey, Mary Ellen, and Dana Loewy, Cengage Learning, 2012.
3. “ *Business Communication Essentials*”, Bovee, Courtland V., and John V. Thill, (6th edition), Prentice Hall, 2013

HS-219 PROFESSIONAL ETHICS

Credit Hours: 2,0

Introduction to Professional & Engineering Ethics: Definitions - Ethics, Professional Ethics, Engineering Ethics, Business Ethics; Ethics & Professionalism. Need and scope of Engineering and Professional Ethics through case studies; Development of Engineering Ethics & Major issues in Engineering & Professional Ethics; Moral Reasoning & Ethical Frameworks: Ethical Dilemma; Resolving Ethical dilemmas and making Moral Choices; Codes of Ethics (of local and international professional bodies). Moral Theories: Utilitarianism, Rights Ethics and Duty Ethics, Syllabi of Courses for Bachelor of Engineering (Computer Systems) Batch: 2018 and Onwards Virtue Ethics Self-Realization & Self Interest; Ethical Problem Solving Techniques: Line drawing, flow Charting, Conflict Problems; case studies and applications; Contemporary Professional Ethics: Professional Responsibilities; Risk and Safety as an Ethical Concern for Engineers, Workplace Responsibilities and Ethics: Teamwork, confidentiality and conflicts of interest, Whistleblowing, Bribe and gift, risk and cost - benefit analyses, gender discrimination and sexual harassment; Environmental Ethics; Computer Ethics & the Internet; Honesty: Truthfulness, trustworthiness, academic and research integrity.

Recommended Books:

1. “ *Ethics in Engineering*”, Mike W. Martin & Roland Schinzinger, (4th edition), Tata McGraw-Hill, 2005.
2. “ *Engineering Ethics*”, Charles B. Fleddermann, Pearson Publishing, 2012.

THIRD YEAR

CT-353 OPERATING SYSTEMS

Credit Hours: 3,1

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-361 ARTIFICIAL INTELLIGENCE & EXPERT SYSTEMS Credit Hours: 3,1

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 By Example: Develop machine intelligence from scratch using real artificial intelligence use cases*”, Denis Rothman, Packt Publishing, 1st Edition, 2018.
2. “*Artificial Intelligence: Structures and Strategies for Complex Problem Solving*”, George F. Luger, Addison Wesley, 6th Edition, 2008.
3. “*Artificial Intelligence: A Modern Approach*”, Stuart Russel and Peter Norvig, Prentice Hall, 3rd Edition, 2009.

CT-362 WEB ENGINEERING Credit Hours: 3,1

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.

CT-363 DESIGN & ANALYSIS OF ALGORITHMS

Credit Hours: 3,0

Introduction; Asymptotic notations; Recursion and recurrence relations; Divide-and-conquer approach; Sorting; Search trees; Heaps; Hashing; Graph algorithms; Shortest paths; Network flow; Disjoint Sets; Polynomial and matrix calculations; Classes of Efficient Algorithms; Divide and Conquer, Dynamic Programming, Greedy Algorithms, Branch and Bound, String Matching algorithms; NP complete problems; Approximation algorithms.

Recommended Books:

1. Introduction to Algorithms, T. H. Cormen, C. E. Leiserson, and R. L. Rivest, MIT Press, McGraw-Hill, 3rd Edition, New York, NY, 2010.
2. Algorithms, Robert Sedgwick, Princeton University Publisher: Addison-Wesley Professional (latest Edition)

CT-364 THEORY OF AUTOMATA & FORMAL LANGUAGES Credit Hours: 3,0

Finite State Models, Formal Languages, Regular Expressions, Regular languages, Finite automata (FAs), Transition graphs (TGs), Deterministic and Non-Deterministic Finite automata , Kleene's theorem, Transducers (automata with output), Pumping lemma and non regular language Grammars, Pushdown Automata (PDA), Context free grammars, Derivations, ambiguity in grammars, Parse Trees, Normal form grammars, Decidability, Context sensitive languages, Chomsky's hierarchy of grammars, Turing Machines.

Recommended Books:

1. An Introduction to Formal Languages and Automata, By Peter Linz, 4th edition, Jones & Bartlett Publishers.
2. Introduction to Automata Theory, Languages, and Computation, John Hopcroft and Jeffrey Ullman, Addison-Wesley.

CT-365 SOFTWARE ENGINEERING Credit Hours: 3,0

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, 8th Edition, 2014.
2. *“Software engineering”*, Ian Sommerville, Addison Wesley, 10th Edition, 2015.

CS-351 COMPUTER COMMUNICATION NETWORKS Credit Hours: 3,1

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-353 MICROPROCESSORS & THEIR APPLICATIONS**Credit Hours: 3,1**

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-331 PROBABILITY & STATISTICS**Credit Hours: 3,0****STATISTICS:**

Introduction, Types of data & variables, presentation to data, object, classifications, Tabulation, Frequency distribution, Graphical representation, Simple & Multiple Bar diagrams, Sartorial & Pie-Diagram, Histogram, Frequency Polygon, Frequency Curves & their types.

MEASURES OF CENTRAL TENDENCY AND DISPERSION:

Statistics Averages, Median Mode, Quartiles, Range, Moments, Skew ness & Kurtosis, Quartile Deviation, Mean Deviation, Standard Deviation, Variance & its coefficient, Practical Significance in related problems.

CURVE FITTING:

Introduction, fitting of a first and second degree curve, fitting of exponential and logarithmic

curves, related problems. Principle of least squares, Second order Statistics & Time series not in bit detail.

SIMPLE REGRESSION & CORRELATION

Introduction, Scatter diagrams, Correlation & its Coefficient, Regression lines, Rank Correlation & its Coefficient, Probable Error (P.E), Related problems.

SAMPLING AND SAMPLING DISTRIBUTIONS

Introduction, Population, Parameter & Statistic, Objects of sampling, Sampling distribution of Mean, Standard errors, Sampling & Non-Sampling Errors, Random Sampling, Sampling with & without replacement, Sequential Sampling, Central limit theorem with practical significance in related problems.

STATISTICAL INFERENCE AND TESTING OF HYPOTHESIS

Introduction, Estimation, Types of Estimates, Confidence interval, Tests of Hypothesis, Chi-Square distribution/test, one tails & two tails tests. Application in related problems.

PROBABILITY

Basic concepts, Permutation & Combination, Definitions of probability, Laws of probability. Conditional probability, Baye'snile. Related problems in practical significance.

RANDOM VARIABLES

Introduction, Discrete & Continuous random variables, Random Sequences and transformations. Probability distribution, Probability density function, Distribution function, Mathematical expectations, Moment Generating Function (M.G.F.), Markove random walks chain/ Related problems.

PROBABILITY DISTRIBUTIONS

Introduction, Discrete probability distributions, Binomial Poisson, Hyper geometric & Negative binomial distributions. Continuous probability distribution, Uniform, Exponential & Normal distributions & their practical significance.

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.

MT-442 NUMERICAL METHODS

Credit Hours: 3,0

Error analysis: types of errors (relative, absolute, inherent, round off, truncation), significant digits and numerical instability, flow chart, use any computational tools to analysis the numerical

solutions. 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 equations: 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 equations: 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, 1/3thsimpson'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, Rungekutta method of order 4), numerical solutions of partial differential equations, optimization problem (simplex method), steepest ascent and steepest descent methods.

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, 2009.
3. “*Advanced Engineering Mathematics*”, Erwin Kreyszig, John Wiley & Sons, 10th Edition, 2011.

FINAL YEAR

CT-460 NETWORK & INFORMATION SECURITY

Credit Hours: 3,1

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 and Network Security Principles and Practices*", William Stallings, Prentice Hall, 7th Edition, 2016.
2. "*Cryptography Theory & Practice*", Douglas R. Stinson, Chapman & Hall/CRC, 2nd Edition, 2002.
3. "*Network Security Fundamentals*", Peter Norton and Mike Stockman, Sams, 1st Edition, 1999.
4. "*Network Security: A Beginners Guide*", Eric Maiwald, McGraw-Hill Osbourne, 2nd Edition, 2003.
5. "*Network Security Bible*", Eric Cole, John Wiley & Sons, 2nd Edition, 2009.

CT-465 COMPILER DESIGN

Credit Hours: 3,0

Input and Lexical Analysis; Syntax Analysis. Type Checking. Intermediate Code Generation. Code Generation. Code optimization. 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-499 SOFTWARE-BASED PROJECT

Credit Hours: 0,6

Market oriented Software Project, spread over two semesters.

CS-428 PARALLEL & DISTRIBUTED COMPUTING

Credit Hours: 3,1

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”*, Dezso Sima, Terrence Fountain and Peter Karsuk, Pearson Education, 1st Edition, 1997.
2. *“Introduction to Parallel Computing”*, Ananth Grama, George Karipis, Vipin Kumar and Ansul Gupta, Addison Wesley, 2nd Edition, 2003.

HS-403 ENTREPRENEURSHIP

Credit Hours: 3,0

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.

HS-405 ORGANISATIONAL BEHAVIOUR

Credit Hours: 3,0

Introduction to Organizational Behaviour: Foundations of OB: Management functions, roles, and skills; Effective versus successful managerial activities; replacing intuition with systematic study. Exploring OB challenges and opportunities facing globalization: Improving quality and productivity; improving people skills; managing work force diversity; responding to globalization; empowering people; stimulating innovation and change; coping with temporariness; handling declining employee loyalty; improving ethical behavior.

Foundations of Individual Behaviour: Individuals & Organizations: Biographical traits and ability; and personality. Perceptions and individual decision making: Understanding perception and its significance, factors influencing perception; linking perception and individual decision making; optimizing decision making model; alternative decision making models; issues in decision making. Values, attitudes and job satisfaction: Importance, sources, types of values; sources and types of attitude; attitude and consistency; measuring job satisfaction; determinants of job satisfaction; effect of job satisfaction on employee performance; ways employees can express dissatisfaction. Motivation- basic concepts and applications.

Foundations of Group Behaviour: Group in OB: Defining and classifying groups; stages of group development, work group behaviour; dynamics of groups. Understanding work teams: Team versus group; types of teams, creating high performance teams; turning individuals into team players. Communication: communicating at interpersonal and organizational level. Leadership: basic approaches and contemporary issues. Conflict & negotiation: defining conflict; transition in conflict thought; conflict process; negotiation - strategies, process and issues.

Foundations of Organizational Structure: Organizational structure and design; work design; work stress Organizational culture: definition; culture’s functions, employees and organizational culture. Organization change and development: forces for change; managing planned change, resistance to change; approaches to managing organizational change.

Recommended Books:

1. *“Organizational Behaviour”*, Stephen P. Robins, Timothy A Judge, & Seema Sanghi, 12th edition, Pearson Education, 2006.
2. *“Organizational Behaviour”*, John W. Newstrom & Keith Davis, 11th edition, McGraw Hill Companies, 2002.
3. *“Organizational Behavior”*, Fred Luthans, 10th edition, McGraw-Hill Irwin, 2004.

ELECTIVE COURSES

CT-352 COMPUTER GRAPHICS

Credit Hours: 3,1

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-360 VISUAL PROGRAMMING

Credit Hours: 3,1

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-366 E-COMMERCE

Credit Hours: 3,0

Introducing E-Commerce: E-commerce overview, concepts and business models.

Internet Hardware, Software and Communication

Internet and World Wide Web servers, storage and communication Technologies. Cloud Computing, Software as a Service (SaaS).

E-Commerce Technologies

Generic Trade Cycles. Electronic Markets, Electronic Data Interchange, Internet Commerce.

E-Commerce with Business Perspective

The Value Chain, Competitive Strategy, Inter-Organizational Transactions, Consumer Trade Transactions, the Trade Cycle e-Commerce Sales. SWOT Analysis, Enterprise Resource Planning (ERP), Supply Chain Management (SCM), Customer Relationship Management (CRM).

The Elements of E-Commerce

E-Visibility, Online Information, Customer Registration, Order Processing, Online Payments, E-fulfillment, After-Sales Services.

Internet Marketing: Basis Marketing concepts, internet traffic patterns, On-site marketing techniques

Online Monetary Transaction: Web Payment Systems, standards and taxation issues.

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

E-commerce impact on society, Legal, Policy and Ethical issues.

Recommended Books:

1. "*E-Commerce*" by Kenneth Laudon and Carol Guercio Traver, Prentice Hall; 8 th Edition 2011.
2. "*e-Business and e-Commerce How to Program*", Harvey M. Deitel, Paul J. Deitel and Tem R. Neito, Prentice Hall, 2000.
3. "*The Complete E-Commerce Book*", Janice Reynolds, CMP Books, 2nd Edition, 2004.

CT-462 DISTRIBUTED COMPUTING

Credit Hours: 3,1

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. *“Distributed Systems: Concepts and Design”*, George Coulouris, JeanDollimore, Tim Kindberg, Gordon Blair, 5th Edition , 2011
2. *“Distributed Database Manaement Systems: A Practical Approach”*, Saeed K. Rahimi and Frank S. Haug, Wiley- IEEE Computer Society, 2010.
3. *“Principles of Distributed Database Systems”*, M. Tamer Ozsu, Brooks/Cole Cengage Learning, 3rd Edition, 2003.

CT-463 DATA WAREHOUSING & MINING

Credit Hours: 3,1

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 for I.T. Professionals”*, Paulraj Ponniah, 2nd Edition, 2010.
2. *“Data Warehousing Fundamentals”*, M. Tamer Ozsu, Brooks/Cole Cengage Learning, 3rd Edition, 2003.
3. *“Data Mining Concepts and Techniques”*, Jiawei Han, Micheline Kamber and Jian Pei, Morgan Kaufman Publishers, 3rd Edition, 2012.

CT-464 MODELING AND SIMULATION

Credit Hours: 3,0

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. “*Simulation Modeling and Analysis*”, A. M. Law and W. D. Kelton, Fifth edition, 2014.
2. “*A First Course in Mathematical Modeling*”, Frank R. Giordano, Cengage/Brooks Publishing, 3rd Edition, 2003.
3. “*Theory of Modeling and Simulation*”, Bernard P. Ziegler, Herbert Praehofer and Tag Gon Kim, Academic Press, 2nd Edition, 2000.
4. “*Mathematical Modeling and Simulation: An Introduction for Scientists and Engineers*”, Kai Velten, Wiley-VCH, 2009.

CT- 481 WIRELESS NETWORKS & MOBILE COMPUTING

Credit Hours: 3,1

- 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-484 INTRODUCTION TO CYBER SECURITY

Credit Hours: 3,1

Basic security concepts, Information security terminology, Malware classifications, Types of malware. Server side web applications attacks. Cross-site scripting, SQL Injection, Network

layer security, Cross-site request forgery, Planning and policy, Network protocols and service models. Transport layer security, Wireless security, Cloud & IoT security.

Recommended Books:

1. *“Cybersecurity – Attack and Defense Strategies: Infrastructure security with Red Team and Blue Team tactics”*, Yuri Diogenes, Erdal Ozkaya , Packet Publishing, 2018.
2. *“Applied Network Security Monitoring: Collection, Detection, and Analysis”*, Chris Sanders, Jason Smith, 1st Edition, Publisher: Syngress, 2013.

CT-485 NATURAL LANGUAGE PROCESSING

Credit Hours: 3,0

Deterministic and stochastic grammars, Parsing algorithms, Context Free Grammars, Representing meaning / Semantics, Semantic roles, Temporal representations Corpus-based methods, N-grams and HMMs, Smoothing and backoff, POS tagging and morphology, Information retrieval, Vector space model, Precision and recall, Information extraction, Language translation, Text classification, Categorization, Bag of words model.

Recommended Books:

1. *“Speech and Language Processing”*, Daniel Jurafsky and James H. Martin , 2nd Edition, Publisher: Prentice Hall, 2008.
2. *“Natural Language Processing with Python Quick Start Guide: Going from a Python developer to an effective Natural Language Processing Engineer”*, Nirant Kasliwal, Packet Publishing, 2018.
3. *“Natural Language Processing with Python: Analyzing Text with the Natural Language Toolkit”*, Steven Bird, Ewan Klein and Edward Loper, O'Reilly Media, 2009.