Bangabandhu Sheikh Mujibur Rahman Science and Technology University

Faculty of Engineering

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Syllabus for B.Sc. Engg.

Session: 2014–2015

Distribution of Courses

	Course type		%		Credits	
1.	**Non-Major Courses**			**22.50**		**36**
	(i) Theory I					
	(a) Mathematics		7.50		12	
	(b) Statistics		2.50		4	
	(c) Physics		1.88		3	
	(d) Electrical and Electronics Engineering		2.50		4	
	Total (Math and Basic Sc.)		**14.38**		**23**	
	(ii) Theory II					
	(a) Economics		1.25		2	
	(b) Accounting		1.25		2	
	(c) English		1.25		2	
	(d) Law		1.25		2	
	Total (Humanities)		**5.00**		**8**	
	(iii) Laboratory					
	(a) Physics		0.62		1	
	(b) Electrical and Electronics Engineering		1.25		2	
	(c) English		1.25		2	
	Total Laboratory (non-major)		**3.12**		**5**	
2.	**Major Course**			**77.50**		**124**
	(i) Major Engineering					
	(a) Theoretical		51.25		82	
	(b) Laboratory		25.00		40	
	(c) Board viva-voce		1.25		2	
	Total			**100.00**		**160**

First Year, Semester I			
Code	Course Title	Contact Hours	Credits
ENG104	**Technical English**	**26**	**2**
ENG105	**English Language Lab I**	**26**	**1**
MAT104	**Algebra, Trigonometry and Vector**	**39**	**3**
EEE104	**Electrical Circuit Analysis**	**26**	**2**
EEE105	**Electrical Circuit Analysis Lab**	**26**	**1**
CSE100	Computer Fundamentals	26	2
CSE102	Structured Programming Language	39	3
CSE103	Structured Programming Language Lab	78	3
CSE110	Discrete Mathematics	39	3
	Total		**20**

First Year, Semester II			
Code	Course Title	Contact Hours	Credits
STA154	**Statistics for Engineers**	**26**	**2**
MAT156	**Differential and Integral Calculus**	**39**	**3**
PHY154	**Physics**	**39**	**3**
PHY155	**Physics Lab**	**26**	**1**
EEE156	**Electronic Devices and Circuits**	**26**	**2**
EEE157	**Electronic Devices and Circuits Lab**	**26**	**1**
CSE150	Data Structure	39	3
CSE151	Data Structure Lab	52	2
CSE168	Project	26	1
	Total		**18**

Second Year, Semester I			
Code	Course Title	Contact Hours	Credits
STA204	**Theory of Statistics**	**26**	**2**

MAT204	**Matrices and Differential Equations**	**39**	**3**
ACC204	**Industrial Management and Accountancy**	**26**	**2**
ECO204	**Economics**	**26**	**2**
CSE200	Introduction to Digital Electronics	26	2
CSE201	Introduction to Digital Electronics Lab	26	1
CSE202	Object Oriented Programming	39	3
CSE203	Object Oriented Programming Lab	78	3
CSE221	Engineering Drawing Lab	26	1
	Total		**19**

Second Year, Semester II			
Code	Course Title	Contact Hours	Credits
LAW254	**Cyber and Intellectual Property Law**	**26**	**2**
MAT256	**Linear Algebra**	**39**	**3**
CSE250	Design and Analysis of Algorithms	39	3
CSE251	Design and Analysis of Algorithms Lab	52	2
CSE252	Digital Logic Design	39	3
CSE253	Digital Logic Design Lab	26	1
CSE260	Automata Theory	26	2
CSE262	Numerical Analysis and Concrete Mathematics	26	2
CSE263	Numerical Analysis and Concrete Mathematics Lab	26	1
CSE278	Project	26	1
	Total		**20**

Third Year, Semester I			
Code	Course Title	Contact Hours	Credits
CSE300	System Analysis and Design	39	3
CSE302	Operating System and System Programming	39	3
CSE303	Operating System and System Programming Lab	26	1
CSE310	Computer Architecture and Organization	39	3
CSE311	Computer Architecture and Organization Lab	26	1
CSE312	Computer Networks	39	3
CSE313	Computer Networks Lab	26	1
CSE320	Database Management Systems	39	3
CSE321	Database Management Systems Lab	26	1
	Total		**19**

Third Year, Semester II			
Code	Course Title	Contact Hours	Credits
CSE350	Computer Graphics	39	3
CSE351	Computer Graphics Lab	26	1
CSE352	Compiler Design	39	3
CSE353	Compiler Design Lab	26	1
CSE360	Java Technology	39	3
CSE361	Java Technology Lab	26	1
CSE362	Microprocessor and Assembly Language	39	3
CSE363	Microprocessor and Assembly Language Lab	26	1
CSE370	Software Engineering	39	3
CSE371	Software Engineering Lab	26	1
CSE378	Project	52	2
	Total		**22**

Fourth Year, Semester I			
Code	Course Title	Contact Hours	Credits
CSE400	Parallel Processing and Distributed System	39	3
CSE401	Parallel Processing and Distributed System Lab	26	1
CSE402	Computer Simulation and Modeling	39	3

CSE403	Computer Simulation and Modeling Lab	26	1
CSE410	Digital Signal Processing	39	3
CSE411	Digital Signal Processing Lab	26	1
CSE412	Communication Engineering	39	3
CSE413	Communication Engineering Lab	26	1
Option I	Theory: Should be selected from Table-I	39	3
Option I	Lab course based on Option-I	26	1
CSE448	Project/Thesis	26	1
	Total		**21**

Table-I: Option I			
1	CSE420	Design of VLSI Circuits and Systems	3
	CSE421	Design of VLSI Circuits and Systems Lab	1
2	CSE422	Computer Peripherals and Interfacing	3
	CSE423	Computer Peripherals and Interfacing Lab	1
3	CSE430	Web Engineering	3
	CSE431	Web Engineering Lab	1
4	CSE432	Computational Geometry	3
	CSE433	Computational Geometry Lab	1

Fourth Year, Semester II			
Code	Course Title	Contact Hours	Credits
CSE450	Artificial Intelligence	39	3
CSE451	Artificial Intelligence Lab	26	1
CSE452	Digital Image Processing	39	3
CSE453	Digital Image Processing Lab	26	1
Option II	Theory: Should be selected from Table-II	39	3
Option II	Lab course based on Option-II	26	1
Option III	Theory: Should be selected from Table-II	39	3
Option III	Lab course based on Option-III	26	1
CSE488	Project/Thesis	52	3
CSE489	Board viva-voce	78	2
	Total		**21**

Table-I: Option II and III			
1	CSE460	Distributed Database Management System	3
	CSE461	Distributed Database Management System Lab	1
2	CSE462	Cryptography and Network Security	3
	CSE463	Cryptography and Network Security Lab	1
3	CSE470	Pattern Recognition	3
	CSE471	Pattern Recognition Lab	1
4	CSE472	Multimedia System and Virtual Environment	3
	CSE473	Multimedia System and Virtual Environment Lab	1
5	CSE480	Wireless Communication	3
	CSE481	Wireless Communication Lab	1
6	CSE490	Machine Learning	3
	CSE491	Machine Learning Lab	1

ENG104: Technical English

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]

2 Credits, 26 Contact hours, Exam. Time: 3 hours

English phonetics: the places and manners of articulation of the English sounds;

Vocabulary building: technical and scientific vocabulary; Correct and precise diction, affixes, level of appropriateness. Colloquial and standard, informal and formal.

English grammar: construction of sentences, some grammatical problems; Comprehension; Paragraph writing; Report writing; Business communication and tenders;

Developing reading skill: Strategies of reading, skimming, scanning, predicting, inferring; analyzing and interpreting variety of texts; practicing comprehension from literary and nonliterary texts.
Developing writing skill: Sentences, sentence variety, generating sentences; clarity and correctness of sentences, linking sentences to form paragraphs, writing paragraphs, essays, reports, formal and informal letters.
Books Recommended:

1. A. J. Thomson & A. V. Martinet : **A Practical English Grammar**, *Oxford University Press*
2. John M. Lannon : **Technical Writing**, *Scott Foresman & Co.*
3. A. Ashley : **Oxford Handbook of Commercial Correspondence**, *Oxford University Press*
4. John Swales : **Writing Scientific English**, *Cengage Learning Australia*
5. Robert J. Dixson : **Complete Course in English**, *Prentice Hall*
6. Rajendra Pal & J. S. Korlahalli : **Essentials of Business Communications**, *Sultan Chand & Sons*

ENG105 Technical English Lab I

100 Marks [60% Exam, 30% Quizzes/Class Tests, 10% Attendance]
1 Credits, 26 Contact hours

Laboratory works based on ENG104, **and**
Listening skill and note taking: Listening to recorded texts and class lectures and learning to take useful notes based on listening.
Developing speaking skill: Oral skills including communicative expressions for personal identification, life at home, giving advice and opinion, instruction and directions, requests, complaints, apologies, describing people and places, narrating events.

MAT104: Algebra, Trigonometry and Vector

100 Marks[70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
3 Credits, 39 Contact hours, Exam. Time: 4 hours

Algebra of sets, De Morgan's rule, relation & function. Determinants: Properties and Cramer's rule.
Theory of Equations: Theorem, and relation between roots and coefficients. Solution of cubic equations.
De Moiver' theorem. Deduction from De Moiver's theorem.
Functions of complex arguments. Gregory's series. Summation of series. Hyperbolic functions.
Vector Addition, Multiplication & Differentiation.
Vector Differentiation: Gradient of scalar function, Divergence and curl of vector function. Physical significance of gradient, divergence and curl.
Vector Integration: Definitions of line, surface and volume integral. Integral forms of gradient, divergence and curl, Divergence Theorem, Stoke's theorem, Green's theorem and Gauss's theorem.

Books Recommended:

1. H. S. Hall and S. R. Knight : **Higher Algebra**, *MacMillan Publications, Arihant Publishers*
2. B. C. Das and B. N. Mukherjee : **Higher Trigonometry**, *U. N. Dhur and Sons*
3. M. R. Spiegel, S. Lipschutz, and D. Spellman : **Vector Analysis and An Introduction to Tensor Analysis**, *McGraw-Hill*
4. W. S. Burnside and A. W. Panton : **Theory of Equations,** *Nabu Press*
5. Samuel Barnard and James M. Child : **Higher Algebra**, *MacMillan Publications*

EEE104: Electrical Circuit Analysis

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
2 Credits, 26 Contact hours, Exam. Time: 3 hours

Instrumentation: Avometer, signal generator, oscilloscope, pH-meter, spectrophotometers, GM and scintillation counters, thermostates.
Networks Analysis: Kirchhoff's laws; Wheatstone bridge, Superposition theorem; Millman's theorem; Reciprocity theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Mesh and Node circuit analysis, Reduction of complicated networks, T and π-section network.
Filters: Properties of symmetrical networks, Characteristics impedance, Filter fundamentals, Different types of

filters, Constant - K and m - derived filters, Design conditions & uses, Active Filters.

Books Recommended:

1. A.K. Sowhney : **A Course in Electrical and Electronic Measurements and Instrumentation** , *Dhanpat Rai and Co.*
2. John D. Ryder : **Networks, Lines and Fields**, *Prentice Hall.*

EEE105: Electrical Circuit Analysis Lab

100 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on EE**E104**

CSE100: Computer Fundamentals

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
2 Credits, 26 Contact hours, Exam. Time: 3 hours

Computer Basics: Introduction to Studying Computers, History and development of Computers, Generation of Computers, Types of Computers.
Computer Hardware and Peripherals: Basic Units of Computer Hardware, Keyboard, Mouse, Internal structure of CPU, Functions of RAM, ROM and Cache memory, Basic functional mechanism of HDD and CD-ROM, Different types of Monitors, Impact and Non-impact Printers, Scanner, Plotter, Typical Computer specifications.
Software: Classifications, System software, Operating system concepts and importance, components and basic functions of DOS, Windows operating system, Application software's and Utility programs, Computer Virus.
Data Processing: Concepts of Data, Information, and Database, Traditional File Processing, DBMS, LATEX as a scientific word processing.
Computer Networks: Computer networks and its goals, Basic concepts on LAN, MAN, WAN and Internet systems, Internet services, Functions of Modem in Internet.

Books Recommended:

1. Peter Norton : **Introduction to Computer**, *McGraw-hill Publishers*
2. J. Stanley Warford : **Computer Systems**, *Jones & Bartlett Publishers*
3. P. Norton : **Inside the PC**, *Sam Publishers*
4. L. Rosch : **Hardware Bible**, *Braddy Publishing, Indianapolis*
5. Subramanian : **Introduction to Computers**, *Mcgraw-hill Inc.*
6. V. K. Jain : **Switching Theory and Digital Electronics**, *Khanna Publishers*

CSE102: Structured Programming Language

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
3 Credits, 39 Contact hours, Exam. Time: 4 hours

Introduction: Programming languages, basic concepts of compiler, interpreter, algorithm and flowchart.
Simple C: Program structure in C, program creating, compiling, debugging and running, basic I/O functions, identifiers and keywords, primitive data types, variables, constants, operators, bitwise operators, comments, decision making statements with if and switch; looping structures with for, while, do-while, goto;
Compound Data Types: Array, structures, union, pointes, strings, dynamic allocation, static, global, external and registrar, user defined data types
Functions: C Functions and user defined functions, function types, function and pointers, parameters, prototypes, recursive function.
File Handling: Concepts, character and file I/O, basics of file I/O, ANSI Standard Libraries.
Others: Standard Library, Pre-processors with define, include, macro, ifdef; uses of graphics functions and project management with user-defined header files

Books Recommended:

1. Kernighan and Ritchie : **The C Programming Language**, *Prentice Hall*
2. Gotfreid : **Programming with C**, **Schaum's Outline Series**, *Tata McGraw Hill*
3. D.E. Knuth : **The Art of Computer Programming**, *Addison-Wesley Professional*
4. E. Balagurusamy : **Programming with ANSI C**, *Tata McGraw Hill*
5. H. Schildt : **Teach yourself C,** *McGraw-Hill Publishers*

CSE103: Structured Programming Language Lab

100 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
3 Credit, 78 Contact hours

Laboratory works based on **CSE102**

CSE110: Discrete Mathematics

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
3 Credits, 39 Contact hours, Exam. Time: 4 hours

Mathematical Logic: Connectives, normal Forms, theory of inference for proposition calculus, predicate calculus, inference theory of predicate calculus, method of proof, mathematical induction.
Sets: Basic concept of set theory, operation of sets, ordered pairs and n-tuples.
Relation and ordering: Relations, properties of Binary relation in a set, composition of binary relation, relation matrix and graph of a relation, partial ordering, path in relation and di-graph.
Functions: definition, composition of function, inverse function, binary and array operation.
Ordered relation and structure: Partially ordered set, external element of P.O. set, Lattice, finite Boolean algebra, function on Boolean algebra, Boolean function as Boolean polynomial.
Graph: Introduction to graph, graph terminology, representing graph and graph isomorphism, paths, reachability, connectivity, Euler and Hamilton path, shortest path problems, graph colouring, matrix representation of graph.
Trees: Introduction of trees, application of trees, tree traversal, labeling trees, trees and sorting, spanning trees, minimal spanning tree, undirected trees.
Algebraic structure: Algebraic system, general properties, some simple algebraic system.
Semigroup and monoids: Homomorphism of semi-groups and monoid, Grammars and languages, Formal definition of a language.
Group: Definition and examples, homomorphism, product and quotients of group.

Books Recommended:

1.	Kenneth H. Rosen	:	**Discrete Mathematics and Its Applications**, *McGraw-Hill*.
2.	J. P. Tremblay and R. Manohar	:	**Discrete Mathematics structures with applications to Computer Science**, *Mc-Graw Hill*
3.	C.L. Liu	:	**Elements of Discrete Mathematics**, *McGraw-Hill*.
4.	Seymour Lipschutz	:	**Theory and Problems of Discrete Mathematics, Schaum's Outline Series**, *McGraw-Hill*
5	Bernard Kolman, Robert Busby, Sharon C. Ross		**Discrete Mathematical Structures**, *Prentice Hall*

STA154: Statistics for Engineers

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
2 Credits, 26 Contact hours, Exam. Time: 3 hours

Statistics: Meaning & Scope, Variables and Attributes, Collection and presentation of Statistical data, Frequency Distribution and Graphical Representation.
Analysis of Statistical Data: Location, Dispersion and their measures. Skewness, Kurtosis and their measures. Moment and Cumulants.
Correlation theory: Linear correlation. Measures of correlation and its significance.
Regression and curve fitting: Linear and non-linear regression. Methods of least squares. Curve fitting.
Elements of Probabilities: Concept of probability, Sample Space, Events. Union and Intersection of Events. Probability of Events. Laws of probability. Conditional Probabilities. Bose Einstein Statistics. Bays probability.
Random Variables and Probability Distribution: Basic concepts. Discrete and continuous Random variables. Density and distribution functions. Mathematical Expectation and variance. Conditional Expectation and conditional variance. Expected values and variances of the density distributions. Moments and Cumulant generating functions. Characteristic function. Study of Binomial, Poisson, Normal. Geometric, Negative Binomial, Hypergeometric, Multinomial, uniform, exponential, Log normal, Logarithmic, Beta and Gamma, Cauchy and Weibul distributions.
Stochastic process. Chebysec's Inequality, Markov chain (discrete and continuous). Queuing theory - Birth death process in queuing. Examples from computer science. Queuing models. (Elementary concepts).

Books Recommended:

1.	A. J. B. Anderson	:	**Interpreting Data.** *Chapman and Hall, London*

2. H. Cramer : **The Elements of Probability Theory.** *Wiley, N. Y*
3. P. Hoel, : **Introductory Statistics**, *Wiley and Sons, N. Y.*
4. D. V. Lindley : **Introduction to Probability and Statistics.** Vol-1 *C. U. P. London*
5. S. Lipschutz : **Probability,** *McGraw-Hill, N. Y.*
6. Mosteller, Rourke and Thomas : **Probability With Statistical Applications**, *Addison-Wesley*
7. F. L. Wolf : **Elements of Probability and Statistics,** *McGraw-Hill, N. Y.*
8. T. H. Wonnacot and R. J. Wonnacot : **Introductory Statistics**, *Wiley and Sons. N. Y.*
9. G. U. Yule, and M. G. Kendall : **An Introduction to the Theory of Statistics,** *Charles Griffin, London*

MAT156: Differential and Integral Calculus

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]

3 Credits, 39 Contact hours, Exam. Time: 4 hours

Functions: Domain, Range, Inverse function and graphs of functions, Limits, Continuity, Indeterminate form.
Ordinary Differentiation: Differentiability, Differentiation, Successive differentiation and Leibnitz theorem.
Expansions of functions: Rolle's theorem, Mean value theorem, Taylor's and Maclaurin's formulae .Maximum and minimum of functions of one variable.
Partial Differentiation: Euler's theorem, Tangents and normal.
Asymptotes.
Indefinite Integrals: Method of substitution, Integration by parts, Special trigonometric functions and rational fractions.
Definite Integrals: Fundamental theorem, General properties, Evaluations of definite integrals and reduction formulas. Improper integral.
Multiple Integrals: Determination of lengths, Areas and Volumes.

Books Recommended:

1. B. C. Das and B.N.Mukherjee : **Differential Calculus,** *U. N. Dhur & Sons*
2. B. C. Das and B.N.Mukherjee : **Integral Calculus,** *U. N. Dhur & Sons*
3. F. Ayres and Elliot Mendelson : **Calculas (Schaum's Outline Series**), *McGraw-Hill*
4. Joseph Edwards : **Differential Calculas,** *Kessinger Publishing*
5. Md. Abdul Latif and S. Bhattacharjee : **Differential Calculus,** *Chandaapure, Chittagong*
6. Md. Abdul Latif and S. Bhattacharjee : **Differential Calculus,** *Chandaapure, Chittagong*

PHY154: Physics

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]

3 Credits, 39 Contact hours, Exam. Time: 4 hours

Mechanics: Motion in two dimensions; projectile motion; Newton's laws of motion; conservation theorems (momentum and energy); collisions; circular motion; rotational dynamics of rigid bodies; central forces and gravitation; Kepler's laws.
Waves: Simple harmonic motion; damped and forced vibrations; waves in elastic media; sound waves; Doppler effect; Fourier's theorem and its applications.
Heat and thermodynamics: Principles of thermometry; measurement of high and low temperature; zeroeth law of thermodynamics, kinetic theory of ideal gas; first and second laws of thermodynamics; entropy; black body radiation. Wein's law and Planck's law.
Optics: Nature and propagation of light, interference of light, Young's experiment, Newton's ring. Michelson Interferometer.
Diffraction: Fraunhofer and Fresnel diffraction, diffraction grating. Polarisation of light, optical activity, polarimetry.
Electromagnetism: Different electrical units; Coulomb's law; electric field; Gauss's law and its applications; electric potential and potential energy; capacitance, dielectrics and Gauss's Law, three electric vectors, energy storage in an electric field. magnetic field and field strength; magnetic forces on a current; torque on a current loop; Hall effect; Ampere's Law; Biot-Savart Law and their applications. Faraday's Law of induction; Lenz's Law; time-varying magnetic field; inductance; energy in magnetic field. Maxwell's equations; EM energy; Poynting Vector; Scalar and vector potentials; the wave equations. Plane EM waves in non-conducting media; waves in conducting media; boundary conditions; reflection and refraction at boundaries of two non-conducting media; total internal reflections.

Books Recommended:

1. D. Halliday and R Resnick, : *Physics* (Vol. II)

2. S. G. Lipson, and H. Lipson, : *Light*
3. F.A. Jenkins and H.A. White : *Fundamentals of Optics*
4. D.J. Griffith : *Introduction to Electrodynamics*
5. A. Beiser. : *Concepts of Modern Physics*

PHY155: Physics Lab

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]

1 Credit, 26 Contact hours
Laboratory works based on **PHY154**

EEE156: Electronic Devices and Circuits

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
2 Credits, 26 Contact hours, Exam. Time: 3 hours

Semiconductor Diodes: n-and p-type semiconductors, p-n junction diodes and their volt-ampere characteristics, zener diode, half-and full wave rectifiers, voltage regulation using zener diodes.
Transistor: Transistor action, types of brazing and bias stabilization, DC characteristics of CE, CB and CC configurations.
Transistor Amplifiers and Oscillators: CE, CB and CC amplifiers, current, voltage and power gains, frequency responses: principles of feedback, positive and negative feedback, oscillators: RC, Hartely and Colpitt's oscillator.
Operational Amplifier: Difference amplifier, CMRR, Ideal operational amplifier, Inverting amplifier, Non-inverting amplifier, General purpose IC operational amplifier, Integrator, Differentiator, Linear and non-linear applications of operational amplifier, Comparator and Converter.
Optoelectronic Devices: PN photodiode, Phototransistor, Solar cell, Photoconductive cell, Photovoltaic, Sensors, LED, LCD, Alphanumeric display, Photo couplers, Photodiode, LDR.

Books Recommended:

1. Jacob Millman and Christos C. Halkias : **Electronic Devices and Circuits,** *McGraw-Hill Inc.*
2. Albert D. Helfrick and William David Cooper : **Modern Electronics Instrumentation and Measurement Techniques,** *Prentice Hall*
3. Albert Paul Malvino : **Electronic Principles,** *Career Education*

EEE157: Electronic Devices and Circuits Lab

100 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on EE**E156**

CSE150: Data Structure

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
3 Credits, 39 Contact hours, Exam. Time: 4 hours

Arrays: Maximization, ordered lists, sparse matrices, representation of arrays.
Stacks, Queues and Recursion: Different types of stacks and queues: Circular, dequeues, etc; evaluation of expressions, multiple stacks and queues;
Recursion: Direct and indirect recursion, depth of recursion; Simulation of Recursion, Removal of recursion.
Linked Lists: singly linked lists, linked stacks and queues, the storage pool, polynomial addition, equivalence relations, sparse matrices, doubly linked lists and dynamic storage management, generalized lists, garbage collection and compaction.
Trees: Basic terminology, binary trees, binary tree representations, binary tree traversal; Extended binary trees: 2-trees, internal and external path lengths, Huffman codes/algorithms; threaded binary trees, binary tree representation of trees; Application of Trees: Set representation, decision trees, games trees: Counting binary trees.
Graphs: Introduction, definitions and terminology, graph representations, traversals, connected components and spanning trees, shortest path and transitive closure, activity networks, topological sort and critical paths, enumerating all paths.
Symbol Tables: static tree tables, dynamic tree tables; Hash Tables: Hashing functions overflow handling, theoretical evaluation of overflow techniques.

Files: file, queries and sequential organizations: Indexing Techniques: Cylinder-surface indexing hashed indexes, tree indexing-B-trees; Tree indexing.

Books Recommended:

1. E. Horowitz and S. Sahni : **Fundamentals of Data Structures,** *Galgotia*.
2. Edward M. Reingold &Wilfred J. Hansen : **Data Structures,** *Addison Wesley Publishers*
3. Niklaus Wirth : **Algorithms + Data Structures = Programs**, *Prentice Hall*
4. Robert L. Kruse : **Data Structures and Program Design**, *Prentice Hall*
5. Seymour Lipshultz : **Data Structures (Schaum's Outline Series),** *Tata McGraw-Hill*
6. E. Horowitz and S. Sahni : **Computer Algorithms**, *Galgotia.*
7. Seymour E. Goodman & S. T. Hedetniemi : **Introduction to Design and Analysis of Algorithms**, *McGraw-Hill.*

CSE151: Data Structure Lab

100 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
2 Credit, 52 Contact hours
Laboratory works based on **CSE150**

CSE168: Project-I

100 Marks [35% Internal Examiner, 35% External Examiner, 30% Presentation and Oral Examination]
1 Credit, 26 Contact hours

Any project based on C language including implementation of Data Structure is acceptable. Gaming project using graphics library in C is preferable. Teachers must have to ensure every project is unique. Innovative project idea should get extra weight to prevent imitating old projects.

STA204: Theory of Statistics

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
2 Credits, 26 Contact hours, Exam. Time: 3 hours

Sampling Distributing: Fisher's Lemma. Study of χ^2 Distribution, T-Distribution and F-Distribution, Properties, uses & Applications. Distribution of sample correlation coefficient in the null case. Sampling Distribution of the Medians and Range.

Elements of Point Estimations: Basic Concepts. consistent estimates. Unbiased estimates. Mean and variance of estimates. Ideas of Efficiency. Principle of Maximum Likelihood. Illustration from Binomial, Poisson & Normal Distributions.

Decision Rules: Statistical decisions; Statistical hypothesis; Critical region, Best critical region; Two types of errors; procedure of Test of hypothesis; Most powerful test, standard Errors.

Test of Significance: Test of single mean & single variance. Comparison of two sample Means, proportions and Variances. Bartlett's test for homogeneity of variances. Test for correlation and Regression coefficients. Exact test for 2*2 tables. Test for r*c tables. Three-Way contingency tables. Large Sample Test of Significance. Non-parametric Test, One Sample and two Sample Sign Test. Run Test and Rank Sum Test.

Recommended Books:

1. R. L. Anderson, T. A. Bancroft : **Statistical Theory in Research,** *McGraw-Hill N. Y. Banctoft, T.*
2. G. Beaumont : **Intermediate Mathematical Statistics,** *Chapman and Hill, London*
3. Gutman, Wilks and Hunter **Introductory Engineering Statistics**, *John Wiley and Sons.*
4. P. G. Hoel : **Introduction to Mathematical Statistics,** *John Wiley and Sons, N. Y.*
5. R. V. Hogg. and A. T. Graig : **Introduction to Mathematical Statistics,** *Collier Macmilan, N. LY.*
6. M. G. Kendall and A. Stuart A. : **The Advanced Theory of Statistics** Vol. 1, *Charles Griffin and Co. London.*
7. B. W. Lindgren : **Statistical Theory,** *Collier-Macmillan Co; N. Y.*
8. Mood, Graybill and Boes : **Introduction to the Theory of Statistics**, *McGraw-Hill, N. Y.*
9. G. B. Weatheril : **Intermediate Statistics Methods,** *Chapman and Hall, London*

MAT204: Matrices and Differential Equations

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]

3 Credits, 39 Contact hours, Exam. Time: 4 hours

Algebra of Matrices: Adjoint, Inverse and rank of matrix-definition, Properties and evaluation.

Elementary Transformations: Echelon: Canonical and normal forms, Solution of system of linear equations, Consistency and solution of homogeneous and nonhomogeneous systems by matrix method, and reduction to equivalent system.

Characteristic Equation: Eigenvalues, Eigenvectors and Caley-Hamilton theorem, Similar matrices and diagonalization.

Solutions of first order and first degree and first-order and higher degree equations with variable coefficients.

Solution of Higher-Order linear differential equations.

Differential Equations: Series solution of linear differential equation, Series solution of second order equation with variable coefficients, Solutions of partial differential equation, Laplace's equation and transformation, Poisson's equation, Helmholtz's equation, Diffusion equation, Green's function solution, Integral equation.

Books Recommended:

1.	M. L. Khanna	:	**Matrices,** *Jai Prakash Nath and Co.*
2.	Shepley L. Ross	:	**Introduction to Ordinary Differential Equations**, *Wiley.*
3.	Jr. Frank Ayres	:	**Theory and Problems of Matrices**, **Schaum's Outline Series,** *McGraw-Hill*
4.	Frank Ayres	:	**Differential Equations,** *McGraw-Hill*
5.	B. D. Sharma	:	**Differential Equations**, *Kedar Nath Ram Nath*.
6.	Louis Albert Pipes	:	**Applied Mathematics for Engineers and Physicist,** *McGraw-Hill*
7.	Ivar Stephen Sokolnikoff and Raymond M. Redheffer	:	**Mathematics of Physics and Modern Engineering**, *McGraw-Hill.*

ACC204: Industrial Management and Accountancy

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
2 Credits, 26 Contact hours, Exam. Time: 3 hours

Industry: Commerce-Industry: Meaning & Characteristics of Industry, Types of Industry; Business: Meaning & Objectives of Business, Types of Business: Sole Proprietorship, Partnership, Joint Stock Company, State Enterprise and Cooperative Society.

Fundamentals of Management: Meaning of Management, Principles of Management, Functions of Management, Levels of Management, Roles of Management, Scientific Management and Core Management skills.

Factory Location and Plant Layout: Factors Determining Location of Factory, Steps in Location, Factors Influencing Layout, Types of Layout, Problems of Layout.

Work-Environment and Plant Utility: Meaning, Importance, Factors Affecting Work Environment, Plant Utility, Lighting, Ventilation, Air-conditioning, Sanitation and Noise Control.

Sole Proprietorships: Features, Advantages, Disadvantages of Sole Proprietorship, Sustainability of Sole proprietorships.

Man Power Planning & Motivation: Need, Objectives, Manpower Planning Process, Recruitment, Selection and Training, Issue in Managing People, Maslow's Need Hierarchy, Social Needs and Productivity, Hygiene and Motivators.

Conflict & Union Management Perspective: Meaning, Process of Conflict, Types of Conflict, Industrial Conflict Resolution Methods, Negotiation Skills, Growth of Trade Unions, Functions, Structure, Leadership and Management in the Trade Union, Collective Bargaining.

Accountings: History, Scope and Nature of Accounting, Purpose of Accounting, Information and Uses

Transaction: Meaning and Features, Accounting Equation, Meaning and Classification of Account, Double entry System, Rules for Determining Debit and Credit, Accounting cycle.

Journal, Ledger and Trial Balance: Meaning, Features, Necessity, Rules, Double and Triple Column Cash Book and Practical Problems.

Work Sheet: Meaning, Purpose, Adjustment Entries and 10 Columns Work Sheet.

Cost Terms Concepts and Classification: Meaning of Cost, Manufacturing and Non Manufacturing Costs, Period and Product Costs, Variable and Fixed Costs, Direct and Indirect Costs, Differential, Opportunity and Sunk Costs, Schedule of Cost of Goods Manufactured, Schedule of Cost of Goods Sold and Income Statement.

Cost-Volume-Profit Relationship: Contribution Margin and Ratio, Break-even Analysis, CVP relationship in Graphical Form and Target Net Profit Analysis.

Books Recommended:

1. M. C. Shukla : **Business Organization and Management,** *S. Chand Publisher.*
2. Harold Koontz and Heinz Weihrich : **Management,** *Tata McGraw-Hill.*
3. Krajewski and Ritzman : **Operation Management,** *Addison-Wesley Publishing Company*
4. David A. Decenzo and Stephen P. Robbins : **Human Resource Management**, *John Wiley & Sons publisher.*
5. Hermanson Etar : **Accounting Principles,** *Business Publications*
6. Ray H. Garrison : **Managerial Accounting,** *Irwin Professional Publishing*

ECO204: Economics

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
2 Credits, 26 Contact hours, Exam. Time: 3 hours

Basic Concepts of Economics: Definition and subject matter of Economics; Microeconomics vs macroeconomics; Law of Economics; Central economic problems of every society; Different economic systems; Economics and Engineering.

Theory of Demand, Supply and Consumer Behavior: Law of Demand; Demand schedule and demand curve; Supply law, Supply schedule and supply curve; Shift in demand and supply; Equilibrium in the market; Elasticity of demand and supply

Production and Costs and Theory of the Firm: Meaning of production; Factors of production; Concepts of total, average and marginal costs, fixed and variable costs.

Theory of the Firm: Perfect competition and monopoly; Total, average and marginal revenue of a firm; Average and marginal revenue under perfect competition and monopoly; Firm's Equilibrium; Equilibrium of firm under perfect competition and monopoly.

The Input-Output Analysis: Meaning of input-output analysis; Input-output analysis model; balance equation; coefficient matrix; Determination of final demand vector.

Basic Concepts of Macroeconomics: Growth; Unemployment; Inflation; Philips Curve, Business cycle; Circular flow of economics; Two, three and four sector economics.

National Income accounting and determination: Concepts of GNP, GDP and national income; Methods of national income accounting; Problems of national income accounting; Keynesian model of national income determination; The multiplier; Effect of fiscal policy in the Keynesian model.

Budgets of Bangladesh: The revenue at the capital budget; Income, expenditure of the government; direct and indirect taxes.

Development Planning in Bangladesh: Need for planning in Bangladesh; Various five year plans in Bangladesh; Development strategies in the five year plans of Bangladesh.

Books Recommended:

1. K. K. Dewett : **Modern Economic Theory,** *S. Chand Publishers*
2. H.L Ahuja : **Advanced Economic Theory,** *S. Chand Publishers*
3. A. Asimakopulos : **An Introduction To Economic Theory: Microeconomics,** *Oxford University Press*
4. A. Koutsoyiannis : **Modern Microeconomics**, *Palgrave Macmillan*

CSE200: Introduction to Digital Electronics

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
2 Credits, 26 Contact hours, Exam. Time: 3 hours

Fundamentals of Digital Logic System: Number Systems and Codes, Binary addition and subtraction, 2's compliment methods.

Logic Gates and Boolean Algebra, Logic Circuit Design, Adder, Subtractor, carry-look-ahead adder, Minimization Techniques: Algebraic Simplification, Karnaugh Map Method, Quine-McCluskey method, Consensus method.

Switching Devices, switching characteristics of diodes, transistor and FETs. Integrated Circuit Logic Families: DTL & TTL logic family, standard TTL series characteristics, other TTL series, TTL loading

rules, TTL open-collector outputs, tri-state TTL. The ECL family. Digital MOSFET circuits, characteristics, CMOS circuits, CMOS tri-state logic, TTL driving CMOS, CMOS driving TTL.

Multivibrators and their applications, Monostable and Astable Multi-vibrators

Books Recommended:

1. Ronald J. Tocci : **Digital Systems: Principles and Applications**, *Prentice Hall*
2. V. K. Jain : **An Introduction to Switching Theory and Digital Electronics**, *Khanna Publishers, New Delhi*
3. M. Morris Mano : **Digital Logic and Computer Design**, *Prentice Hall*
4. William H. Gothmann : **Digital Electronics,** *Prentice Hall*
5. A. Mottershead : **Electronic Devices and Circuits**: An Introduction**,** *Goodyear Pub*
6. Mehta, Rohit, V K Mehta : **Principles of Electronics**, *S. Chand Group*

CSE201: Introduction to Digital Electronics Lab

100 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on **CSE200**

CSE202: Object Oriented Programming

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
3 Credits, 39 Contact hours, Exam. Time: 4 hours

Introduction: Philosophy of Object Oriented Programming (OOP); Advantages of OOP over structured programming; Declaration and Constants, Expression and Statements, Control Structure, Operators, Data Types, Object Oriented I/O; Functions

Object-Based Programming: Encapsulation, classes and objects, access specifiers, Controlling Access to Members, static and non-static members; Constructors, destructors and copy constructors; Abstract classes; Polymorphism, Function and operator overloading, Virtual function, Template, STL, Streams, Tiles, Array of objects, object pointers, and object references;

Object-Oriented Programming: Inheritance: single and multiple inheritance; Function Overriding, Template functions and classes; Multi-threaded Programming, Dynamic method building; Exception handling;

Books Recommended:

1. H. Schidt : **C++: A Beginner's Guide,** *McGraw Hill*
2. H. Schidt : **C++: The Complete Reference**, *McGraw Hill*
3. N. Barkakati : **Object Oriented Programming with C++,** *Prentice Hall India*
4. B. Stroustrap : **The C++ Programming Language**, *Addison-Wesley Professional*

CSE203: Object Oriented Programming Lab

100 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
3 Credit, 78 Contact hours

Laboratory works based on **CSE202**

CSE221: Engineering Drawing Lab

100 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

1st angle and 3rd angle drawing, Isometric, Oblique and Perspective drawing, Projection, Expansion. Fundamentals of Computer Aided Drawing.

LAW254: Cyber and Intellectual Property Law

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
2 Credits, 26 Contact hours, Exam. Time: 3 hours

Cyber Law

Cyber Law: Definition Nature, Scope, Utility of Cyber Law, Origin and Development of Cyber Law and Internet

ICT Policy in Bangladesh; Internet Service Providers (ISP)- Domain Name, Present Legal Basis of ISP in Bangladesh; e-Readiness in Bangladesh- e-Commerce in Bangladesh, e-Governance in Bangladesh, e-Learning/Education in Bangladesh, e-Journal in Bangladesh, e-Voting in Bangladesh; Electronic Evidence-

Digital Signature, The Evidence Act of 1872 Vs. ICT Act-2006, Electronic Evidence in Bangladesh, Legal Effects of Electronic Evidence, UNCITRAL Model Law on Electronic Evidence;
Cyber Crime: Jurisdiction and Cyber Crime, Criminal Justice in Bangladesh and Implications on Cyber Crime; Cyber vandalism, Hacking, Malicious Spreading in Viruses, Password fraud, Cheating, Cyber Pornography, Child Pornography, Protection of Copyrights and Intellectual Property right. Invasion of Privacy, Constitutional basis of Privacy, Unsolicited e-Mail, Defamation, Harassment and e-Mail Abuse, Present Legal Protection;
Human Rights Violation and Internet; The Information and Communication Technology Act, 2006-Objectives, Strengths & Weaknesses of the ICT Law, Regulation of Cryptography.

Intellectual Property Law

Intellectual Property Law: Basic Concepts of IP Law, Nature of IPR, Computer-related intellectual property rights; Copyright- Original and development of copyright law, subject matter of copyright protection, Rights protected by copyright, Neighbouring rights, Limitations of Copyright protecting, Piracy and infringement, Remedies, Computer Program, New technology and copyright, Software Patents Vs. Copyright, International Convention on Copyright
Patent- Patents and technological development, Requirements for patentability and ownership of patents, Scope of exclusive rights and duration of protection, Patents infringement, defences and remedies, Legal arrangement for the transfer of technology, Types of intellectual Property licenses
Trademarks- Reasons for the protection of trademarks, Acquisition of trademark right, Registration procedure, Duration of protection and renewal, Termination, Trademarks in Cyberspace; Domain Name and Meta-tag Controversies.

Books Recommended:

1. Vivck Sood : **Cyber Law Simplified,** *Tata McGraw Hill Publications.*
2. V. D. Dudej : **Information Technology & Cyber Laws**, *Commonwealth Publishers.*
3. Arpad Bogsch : **Universal Copyright Convention: An Analysis and Commentary,** *Bowker*
4. Alan Daubeny Russell Clarke : **Copyright in Industrial Designs,** *Sweet and M.*

MAT256: Linear Algebra

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
3 Credits, 39 Contact hours, Exam. Time: 4 hours

Vector space, subspace, sum and direct sum.
Linear dependence and independence basis and dimension.
Linear transformation: range, kernel, nullity, rank, singular and non-singular transformations.
Matrices and linear operators: Matrix representation of a linear operator. Change of basis, similarity, Matrices and linear mapping.
Characteristic roots and vectors of linear transformations, theorems and problems; characteristic and minimum polynomials of square matrices.
Linear functionals and dual vector spaces, Annihilators.
Norms and inner products, Orthogonal complements, orthonormals sets, Gram-schmidt orthogonalization process.
Adjoint operators, Hermotian, Unitary, Orthogonal and Normal operators.

Recommended Books:

1. Seymour Lipschutz, Marc Lipson : **Linear Algebra, Schaum's Outline Series**, *McGraw-Hill*
2. I. N. Herstein : **Topics in Algebra,** *Wiley*

CSE250: Design and Analysis of Algorithms

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
3 Credits, 39 Contact hours, Exam. Time: 4 hours

Basics of Algorithm: Algorithms as a technology, Analyzing algorithms, Designing algorithms, Time and space analysis of algorithms, Average, best and worst case analysis, different notations.
Sorting: Insertion sort, Heapsort, Quicksort, Counting sort, Radix sort, Bucket sort.
Dynamic programming: Assembly-line scheduling, Matrix-chain multiplication, Longest common subsequence, Optimal binary search trees.

Greedy method: An activity-selection problem, Elements of the greedy strategy, Huffman codes.
Graph algorithms: Depth-first search, Breadth-first search, Topological sort, Minimum spanning tree, Kruskal's and Prim's algorithm, Bellman-Ford algorithm, Dijkstra's algorithm, Floyd-Warshall algorithm, Johnson's algorithm for sparse graphs, Ford-Fulkerson method.
Computational Geometry: Line-segment properties, Determining whether any pair of segments intersects, Finding the convex hull, Finding the closest pair of points.
Backtracking: 8 queens problem, Sum of subsets, Graph coloring problem, Hamilton cycles.
Branch and bound: Lest cost search, 15-puzzle problem, Knapsack problem, Traveling salesman problem.
NP-Completeness: Polynomial time, Polynomial-time verification, NP-completeness and reducibility, NP-complete problems.

Recommended Books:

1. Thomas H. Kormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein : **Introduction to Algorithms**, *The MIT Press*
2. D. E. Knuth : **The Art of Computer Programming,** Vol. 1, 2, 3, *Addison-Wesley.*
5. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran : **Fundamentals of Computer Algorithms**, *Galgotia Publications*

CSE251: Design and Analysis of Algorithms Lab

100 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
2 Credit, 52 Contact hours

Laboratory works based on **CSE250**

CSE252: Digital Logic Design

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
3 Credits, 39 Contact hours, Exam. Time: 4 hours

Flip-Flops (FF) and related devices: Transistor Latch, NAND gate latch, NOR gate latch, D latch. Clock signals and Clocked F.Fs: Clocked S-C, J-K and D Flip-Flops, Master/Slave F.Fs

FF timing considerations, Edge triggered and level triggered timing diagrams. F.F. applications, Frequency division and counting. Schmitt Trigger devices,

BCD to decimal decoders, BCD to 7 segments decoder/drivers. Encoders, Priority encoder, Multiplexers, Demultiplexers. Examples of IC packages, 74138, 74151, 74148, Applications, Trouble shooting case studies.

Introduction to sequential circuits: formal representation of sequential circuits, Moore and Mealy models. Counters and Registers: Asynchronous (Ripple) up and down counters, Synchronous up and down Counters. Counters with MOD number $<2^N$. Shift registers Applications of counters and shift registers.

Analog to digital conversion, digital ramp, successive approximation, digital to analog conversion: circuits, specifications.

Architecture of 555 timers, 555 as clock generator and monostable multivibrator

Books Recommended:

1. Ronald J. Tocci : **Digital Systems: Principles and Applications**, *Prentice Hall*
2. V. K. Jain : **An Introduction to Switching Theory and Digital Electronics**, *Khanna Publishers, New Delhi*
3. M. Morris Mano : **Digital Logic and Computer Design**, *Prentice Hall*
4. William H. Gothmann : **Digital Electronics**, *Prentice Hall*
5. A. Mottershead : **Electronic Devices and Circuits: An Introduction,** *Goodyear Pub*
6. Mehta, Rohit, V K Mehta : **Principles of Electronics**, *S. Chand Group*

CSE253: Digital Logic Design Lab

100 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on **CSE252**

CSE260: Automata Theory

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
2 Credits, 26 Contact hours, Exam. Time: 3 hours

Finite Automata: Deterministic and nondeterministic finite automata and their equivalence. Equivalence with regular expressions. Closure properties. The pumping lemma and applications. **Context-free Grammars:** Definitions. Parse trees. The pumping lemma for CFLs and applications. Normal forms. General parsing. Sketch of equivalence with pushdown automata.
Turing Machines: Designing simple TMs. Variations in the basic model(multi-tape, multi-head, nondeterminism). Church-Turing thesis and evidence to support it through the study of other models. **Undecidability:** The undecidability of the halting problem. Reductions to other problems. Reduction in general

Books Recommended:

1. J. C. Martin : **Introduction to Languages and the Theory of Computation**, *McGraw Hill Publications*
2. Hopcroft and Ulman : **Introduction to Automata Theory, Languages and Computation**, *University of Toronto*

CSE262: Numerical Analysis and Concrete Mathematics

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
2 Credits, 26 Contact hours, Exam. Time: 3 hours

Approximations and Errors: Accuracy and Precision, Error Definitions, Round-Off Errors, Truncation Errors.
Roots of Equations: Graphical Methods, The Bisection Method, The False-Position Method, Simple One-Point Iteration, The Newton-Raphson Method, The Secant Method.
Systems of linear algebraic equations: Gauss Elimination, Solving Small Numbers of Equations, Naive Gauss Elimination, Pitfalls of Elimination Methods, Matrix Inversion and Gauss –Seidel, The Matrix Inverse, Error Analysis and System Condition.
Curve Fitting: Linear Regression, Polynomial Regression, Multiple Linear Regression, Newton's Forward and Backward Formula for Equal Interpolation Theorem, Gauss's Interpolation Formolae, Newton's Divided Difference Interpolating Polynomials, Lagrange Interpolating Polynomials, Coefficients of an Interpolating Polynomials, Curve Fitting with Sinusoidal Functions.
Numerical Differentiation and Integration : The Trapezoidal Rule, Simpson's Rules, Integration with Unequal Segments, Romberg Integration, Gauss Quadrature, High-Accuracy Differentiation Formulas, Richardson Extrapolation, Derivatives of Unequally Spaced Data.
Numerical Solutions of Ordinary Differential Equations: Euler's Method, Modifications and Improvements of Euler's Methods, Runge-Kutta Methods, Adaptive Runge-Kutta Methods.
Concrete Mathematics: Recurrence, Sums, Number Theory, Discrete Probability.

Recommended Books:

1. Steven C. Chapra, Raymond P. Canale : **Numerical Methods for Engineers,** *McGraw-Hill*
2. S. S. Kuo : **Computer Applications of Numerical Methods**, *Addison-Wesley*
3. S. S. Sastry : **Introductory Methods of Numerical Analysis**, *Prentice-Hall of India Pvt. Ltd.*
4. Donald L. Graham, Donald E. Knuth, Oren Patashnik : **ıcrete Mathematics**

CSE263: Numerical Analysis and Concrete Mathematics Lab

100 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours
Laboratory works based on **CSE262**

CSE278: Project-II

100 Marks [35% Internal Examiner, 35% External Examiner, 30% Presentation and Oral Examination]
1 Credit, 26 Contact hours

Project focusing on Object Oriented Programming approach and using standard algorithm is preferable. Every project should maintain a goal so that it can be used as a useful tool in the IT fields. Also innovative project ideas that require different types scripting/programming languages or programming tools can be accepted with respect to the consent of the corresponding project supervisor.

CSE300: System Analysis and Design

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
3 Credits, 39 Contact hours, Exam. Time: 4 hours

Introduction: Introduction to information systems, general design consideration of information systems.
Overview: system concepts and the information systems environment, information needs, the concepts of MIS, the system development life cycle, the role of the systems analysis.
Systems Analysis: Systems planning and the initial investigation, information gathering, the tools of structured analysis, feasibility study, cost benefit analysis.
Systems Design: The process and stages of systems design, input/output and forms design, file organization and data base design.
System Implementation: system testing and quality assurance, implementation and software maintenance, hardware/software selection, project scheduling and software, Security, disaster/recovery, and ethics in system development.
Case study: Case studies of various information systems such as: Library management system, inventory system, voter identity management system, payroll system, etc.

Books Recommended:

1.	E.M. Awad	:	**System Analysis and Design**, *Galgotia Publication Ltd*
2.	P. Edwards	:	**System Analysis & Design,** *McGraw-Hill*
3.	J.G. Burch Jr., F.R. Strater and G. Grundnitski	:	**Information Systems: Theory and Practice,** *John Wiley & Sons.*
4.	G. Scott.	:	**Principles of Management Information Systems**, *McGraw-Hill*
5.	A. Daniels and D. Yeates	:	**Basic System Analysis**, *Galgottia*

CSE302: Operating System and System Programming

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
3 Credits, 39 Contact hours, Exam. Time: 4 hours

Introduction: Introduction to OS. Operating system functions, evaluation of O.S., Different types of O.S.: batch, multi-programmed,time-sharing, real-time, distributed, parallel.
System Structure: Computer system operation, I/O structure, storage structure, storage hierarchy, different types of protections, operating system structure (simple, layered, virtual machine), O/S services, system calls.
Process Management: Processes: Concept of processes, process scheduling, operations on processes, co-operating processes, interprocess communication.
Threads: overview, benefits of threads, user and kernel threads.
CPU scheduling: scheduling criteria, preemptive & non-preemptive scheduling, scheduling algorithms (FCFS, SJF, RR, priority), algorithm evaluation, multi-processor scheduling.
Process Synchronization: background, critical section problem, critical region, synchronization hardware, classical problems of synchronization, semaphores.
Deadlocks: system model, deadlock characterization, methods for handling deadlocks, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock.
Storage Management: Memory Management: Background, logical vs. physical address space, swapping, contiguous memory allocation, paging, segmentation, segmentation with paging.
Virtual Memory: background, demand paging, performance, page replacement, page replacement algorithms (FCFS, LRU), allocation of frames, thrashing.
File Systems: file concept, access methods, directory structure, file system structure, allocation methods (contiguous, linked, indexed), free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency & performance.
I/O Management: I/O hardware, polling, interrupts, DMA, application I/O interface (block and character devices, network devices, clocks and timers, blocking and nonblocking I/O), kernel I/O subsystem (scheduling, buffering, caching, spooling and device reservation, error handling), performance.

Disk Management: Disk reliability, disk formatting, boot block, bad blocks.
Protection & Security: Goals of protection, domain of protection, security problem, authentication, one time password, program threats, system threats, threat monitoring, encryption.

Books Recommended:

1.	Abraham Silberschatz and Peter Baer Galvin	:	**Operating Systems Concepts**, *Wiley Publisher*.
2.	Tanenbaum	:	**Operating Systems**, *Prentice-Hall*
3.	Madnick and J. Donovon	:	**Operating systems**, *McGraw-Hill*
4.	B. Hausen	:	**Operating System Principles**, *Prentice-Hall of India*
5.	Donovan	:	**Systems Programming,** *McGraw-Hill.*
6.	Maurice. J. Bach	:	**The design of the Unix operating system**, *Prentice-Hall.*
7.	M. MilenKovic	:	**Operating System Concept and Design**, *Tata McGraw Hill.*
8.	Terrence	:	**Unix System Programming in C++,** *Prentice Hall* Publication

CSE303: Operating System and System Programming Lab

100 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on **CSE303**

CSE310: Computer Architecture and Organization

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
3 Credits, 39 Contact hours, Exam. Time: 4 hours

Concepts and Terminology: Digital computer components Hardware & Software and their dual nature, recent development, Role of Operating Systems (OS).
Processor Design: Introduction: Processor organization, information representation, number formats; Fixed Point Arithmetic: Addition, subtraction, multiplication, division; ALU Design: Basic ALU organization, floating point arithmetic.
Control Design: Hardwired control: Design methods, multiplier control unit, CPU control unit; Basic concept of Micro programmed Control, Control memory optimization.
Memory Devices and its Organization: Different types of semiconductor memory, magnetic memory, optical memory, virtual memory, memory hierarchies; High-speed Memories: Interleaved memories, caches, associative memories.
System Organization: Communications: Introduction, bus control; IO Systems: Programmed IO, DMA and interrupts, IO processors.
SISD, MISD, MIMD, Single instruction multiple data stream (SIMD) architectures. Array processors, comparison with vector processors, and example of array processors such as MMX Technology.

Books Recommended:

1.	John P. Hayes	:	**Computer Architecture and Organization,** *McGraw-Hill***.**
2.	Carl Hamacher, Zvonko Vranesic and Safwat Zaky	:	**Computer Organization**, *McGraw-Hill.*
3.	Kai Hwang and Faye A. Briggs	:	**Computer Architecture and Parallel Processing**, *McGraw-Hill.*
4.	William Stallings	:	**Computer Organization and Architecture: Designing for Performance**, *Prentice Hall*.

CSE311: Computer Architecture and Organization Lab

100 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on **CSE310**

CSE312: Computer Networks

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]

3 Credits, 39 Contact hours, Exam. Time: 4 hours

Introduction: Computer Networks and Applications, OSI reference model, TCP/IP model and terminology, Connectionless and Connection Oriented services, Service primitives, The ARPANET
Physical Layer: Circuit switching and Packet switching, X-25 protocol, Frame relay and Cell relay, ATM reference model.
Medium Access Sublayer: Pure and slotted ALOHA, Persistent and Non persistent CSMA, CSMA with collision detection and collision free protocols, IEEE standard 802.3 and Ethernet.
Data Link Layer: Types of errors, framing, error detection & correction methods; Flow control, Stop & wait ARQ, Go-Back- N ARQ, Selective repeat ARQ, HDLC.
Network Layer: Internet address, classful address, subnetting, static vs. dynamic routing, shortest path algorithm, flooding, distance vector routing, link state routing, ARP, RARP, IP, ICMP.
Transport Layer: UDP, TCP, Connection management, Addressing, Establishing and Releasing Connection, Congestion control algorithm, Flow control and Buffering, Multiplexing.
Presentation Layer: Data Compression techniques, Frequency Dependent Coding, Context Dependent Encoding.
Application Layer: Internet and intranets, Internet services and goals, DNS, SMTP, FTP, Telnet, HTTP, World Wide Web (WWW), DHCP and BOOTP.

Books Recommended:

1. Behrouz A. Forouzan : **TCP/IP Protocol Suite**, *McGraw-Hill*
2. Andrew S. Tanenbaum : **Computer Networks**, *Prentice Hall*
3. William Stallings : **Data and Computer Communications**, *Prentice Hall*
4. Behrouz A. Forouzan : **Data Communications and Networking**, *McGraw-Hill*

CSE313: Computer Networks Lab

100 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on **CSE312**

CSE320: Database Management Systems

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
3 Credits, 39 Contact hours, Exam. Time: 4 hours

Introduction to database system: Overview, File system VS database system, Advantage of a DBMS, Describing and storing in a DBMS, Queries in a DBMS, Transaction management, Structure of a DBMS, Applications.
The Entity-Relationship model: Basic concept, Design issue, Mapping constraints, Keys, E-R diagram, Weak entity sets, Extended E-R features, Design of an E-R database schema, Reduction of a E-R schema to tables.
Relational model: Structure of relational databases, The relational algebra, The tuple relational calculus, the domain relational calculus, relational algebra operations, modification of the database, introduction to views.
Structured Query Language: The form of a basic SQL query, UNION, INTERSECTION and EXCEPT, nested queries, aggregate operations, null values, embedded SQL, cursors, dynamic SQL, ODBC and JDBC, triggers and active database.
Relational database design: Pitfalls in relational database design, Decomposition, normalization using functional dependencies, normalization using multivalued dependencies, normalization using join dependencies, domain-key normal form.
Object oriented and object relational databases: The object oriented data model, nested relations, complex types and object orientation, querying with complex types, creation of complex values and objects.
Storage and file structure: File & Record Concept, Placing file records on Disk, Fixed and Variable sized Records, Types of Single-Level Index (primary, secondary, clustering), Multilevel Indexes, Dynamic Multilevel Indexes using B tree and B+ tree .
Query processing: Catalog information for cost estimation, measuring of query cost, different operations, evaluation of expressions, and choice of evaluation plans.
Concurrency control: Lock based protocols, timestamp based protocols, validation based protocols, multiple granularity, multiversion schemes, deadlock handling, insert and delete operations.
Recovery system: Failure classification, storage structure, recovery and atomicity, log-based recovery, shadow paging, recovery with concurrent transactions, buffer management, advanced recovery techniques.

Database system architecture: Centralized systems, client-server systems, parallel systems, distributed systems, network types

An introduction to parallel and distributed database: Oracle: introduction to SQL plus, PL/SQL, triggers, forms, reports, query, procedures, and project builder.

Books Recommended:

1. A. Silberschatz : **Database System Concepts,** *Mcgraw-Hill.*
2. Raghu Ramakrishnan, Johannes Gehrke : **Database Management System,** *McGraw-Hill Higher Education*
3. James Martin : **Principles of Database Management**, *Prentice-hall Of India Pvt Ltd*
4. Ullman : **Database Management systems**, *Prentice-Hall Publication.*
5. Abey : **Oracle 8i a Beginners Guide**, *McGraw Hill.*

CSE321: Database Management Systems Lab

100 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on **CSE320**

CSE350: Computer Graphics

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
3 Credits, 39 Contact hours, Exam. Time: 4 hours

Introduction to Computer Graphics and Graphics systems: Overview of computer graphics, representing pictures, preparing, presenting and interacting with pictures for presentations; Visualization and image processing; RGB color model, direct coding, lookup table; storage tube graphics display, Raster scan display, 3D viewing devices, Plotters, printers, digitizers, Light pens etc.; Active and Passive graphics devices; Computer graphics software.

Scan conversion: Points & lines, Line drawing algorithms; DDA algorithm, Bresenham's line algorithm, Circle generation algorithm; Ellipse generating algorithm; scan line polygon, fill algorithm, boundary fill algorithm, flood fill algorithm.

2D transformation and viewing: Basic transformations: translation, rotation, scaling; Matrix representations and homogeneous coordinates, transformations between coordinate systems; reflection shear; Transformation of points, lines, parallel lines, intersecting lines. Viewing pipeline, Window to view port co-ordinate transformation, clipping operations, point clipping, line clipping, clipping circles, polygons & ellipse.

3D transformation and viewing: 3D transformations: translation, rotation, scaling and other transformations. Rotation about an arbitrary axis in space, reflection through an arbitrary plane; general parallel projection transformation; clipping, view port clipping, 3D viewing.

Curves: Curve representation, surfaces, designs, Bezier curves, B-spline curves, end conditions for periodic Bspline curves, rational B-spline curves.

Hidden surfaces: Depth comparison, Z-buffer algorithm, Back face detection, BSP tree method, the Printer's algorithm, scan-line algorithm; Hidden line elimination, wire frame methods, fractal - geometry.

Color and shading models: Light & color model; interpolative shading model; Texture;

Books Recommended:

1. Donald Hearn and M. Pauline Baker : **Computer Graphics**, *Prentice Hall*
2. Steven Harrington : **Computer Graphics: A Programming Approach,** *McGraw-Hill College***.**
3. F. S. Hill : **Fundamentals of Computer Graphics,** *Prentice Hall*
4. Plastock and Kalley : **Computer Graphics,** *Mcgraw-hill.*
5. Zhigang Xiang & Roy Plastock : **Computer Graphics**, *Mcgraw-hill.*

CSE351: Computer Graphics Lab

100 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on **CSE350**

CSE352: Compiler Design

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
3 Credits, 39 Contact hours, Exam. Time: 4 hours

Introduction: Introduction to compiler, compiler and translator, the structure of a compiler.
Grammars: Notation and concepts for languages and Grammars, sets and string, Discussion and classification of Grammars, Scanner regular expression, regular definition, finite automata, LL and LR Grammars, ambiguous grammar.
Parsing: Basic parsing technique, parsers, shift reduce parsing, operator-procedure parsing, top-down parsing, bottom up parsing, predictive parsing.
Syntax: Syntax directed translation, intermediate code generation, polish notation, parse tree and syntax trees, quadruples, triples, Boolean expression.
Table: Perspective and motivation of symbol table. Symbol table content, operation on symbol table, organization of symbol table.
Flowgraph: Code optimization, sources of optimization, basic blocks, folding, loop optimization, flowgraph, induction variable elimination, reduction in strength, code motion.
Error: Compile time error handling, error detection, error recovery, error repair.
Coding: Code generation, object programs, problems in code generation, a machine model, a simple code generator, register allocation and assignment peephole optimization.

Books Recommended:

1. Alfred V. Aho and Jeffrey D. Ullman : **Principles of Compiler Design**, *Addison-Wesley Publication*.
2. A.J. Holub : **Compiler design in C**, *Prentice-Hall of India*
3. Trembly and Sorensen : **Theory and Practices of Compiler Writing,** *McGraw-Hill computer science series.*
4. Hopcroft and Ulman : **Introduction to Automata Theory, Languages and Computation**, *University of Toronto*
5. Adamek : **Automata and Algebra**, *Kluwer Academic* Publishers *Norwell, MA, USA.*

CSE353: Compiler Design Lab

100 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on **CSE352**

CSE360: Java Technology

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
3 Credits, 39 Contact hours, Exam. Time: 4 hours

Introduction: The Java Programming Environment, Object and classes, Inheritance. Interfaces and Inner Classes, Controlling Program Flow, Initialization & Cleanup, Hiding the implementation, Polymorphism, Error handling with exceptions.
Graphics Programming: User Interface Components with swing, AWT, GWT,Applets, Streams and Files.
Java I/O: The Java I/O system, Run-time type Identification, Creating windows & Applets, Threads and Multi-threads, Distributed Computing,
Advance Java: Java API Library, Enterprise Java frame work, application model, multi-tier application, Java servlets, Java server pages(JSP), Java Beans, JDBC, Remote Method Invocation(RMI), Naming Service, Serialization, Internationalization, JSTL, Network Programming.

Books Recommended:

1. Deitel & Deitel : **Java How to Program**, *Prentice-Hall Inc.*
2. Cay Horstmann and Gary Cornell : **Core Java Vol. 1 & 2,** *The Sun Microsystems Press Java Series, Prentice-Hall*
3. Ivor Horton : **Beginning Java 2:** John Wiley & Sons.
4. H. Schidlt : **Java: The Complete Reference,** *McGraw-Hill*

CSE361: Java Technology Lab.

100 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on **CSE360**

CSE362: Microprocessor and Assembly Language

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
3 Credits, 39 Contact hours, Exam. Time: 4 hours

Microprocessor Fundamentals: Architecture of a microprocessor, Data bus, address bus, control bus, I/O units and memory.
Architecture: Architecture of Intel 8086 Microprocessor, its execution unit and bus-interface unit, its registers and flags.
Programming Model: Programming model of 8086 processor, segment-offset address and physical address calculations, even and odd addressing, introduction of different addressing modes, Operating systems and BIOS, Memory organization of PC.
Assembly Language: Introduction to IMB PC Assembly Language, Assembly Language syntax, Program Data, Variables, Named constants, program structure, memory models, Input/Output instruction, Running program, Program Segment Prefix.
Status Register: The processor status and the Flag register, Overflow condition, Debugging a program.
Flow control: Flow control instructions, Conditional jumps, signed versus unsigned jumps, High-level language structures, branching and looping structures.
Logic Operation: Logic, Shift and Rotate Instruction, some common applications of Shift and Rotate operations.
Data Structure: The Stack and Introduction to Procedures, Basic stack operations, Procedures Declaration, Communication between procedures, calling a procedures.
Arithmetic Operation: Multiplication and Division Instructions, signed versus unsigned multiplications, Divide overflow, Signed Extension of Dividend.
Arrays: Arrays and related addressing modes, DUP operator, Register indirect modes, Based and Indexed addressing modes.
String Manipulation: The string instructions, director flag, Moving a string, storing a string, Loading a string, scanning a string, comparing strings, substring operation.
Introduction to Microcontroller: Microcontroller Architecture, Addressing mode and instruction sets, PIC and 8051 Family Microcontroller.

Books Recommended:

1. Ytha Yu and Charlers Marut : **Assembly Language Programming and Organization of the IBM PC,** *McGraw-Hill*
2. Rafiquzzaman : **Microprocessor and Microcomputer based System Design**, *Crc Press Publication*
3. D. V. Hall : **Microprocessors and Interfacing**, *McGraw-Hill*
4. Y. Liu and G. A. Gibson : **Microcomputer Systems: 8086/8088 Family,** *Prentice-Hall*
5. Artwick : **Microcomputer Interfacing,** *Prentice-Hall series.*
6. Ramesh Goanker : **Microcomputer Interfacing**, *McGraw-Hill*

CSE363: Microprocessor and Assembly Language Lab

100 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on **CSE362**

CSE370: Software Engineering

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
3 Credits, 39 Contact hours, Exam. Time: 4 hours

Introduction: Introduction to software engineering, Importance of software, The Software evolution, Software characteristics, Software components, Software applications, Crisis-Problem and causes.
Software development life-cycle: Requirement analysis, software design, coding, testing and maintenance etc.

Software requirement Specification: Water fall model, prototyping interactive enhancement, spiral model role of management in software development, role of matrices and measurement, Problem analysis, requirement specification, validation, matrices, monitoring and control.
System Design: Problem partitioning, abstraction, top down and bottom up – design, structured approach, functional versus object oriented approach, design specification and verification matrices, monitoring and control, Cohesiveness, coupling, 4 GL.
Coding: TOP-DOWN and BOTTOM-UP structure programming, information hiding, programming style, and internal documentation, verification, metrics, monitoring and control.
Testing: levels of testing, functional testing, structural testing, test plane, test class specification, reliability assessment, Software testing strategies, Verification and validation, Unit, Integration Testing, Top down and bottom up integration testing, Alpha and Beta testing, System testing and debugging.
Software project Management: Cost estimation, project scheduling, staffing, software configuration management, structured Vs unstructured maintenance, quality assurance, project monitoring, risk management.
Function oriented and object oriented Software design: Overview of SA/SD Methodology, structured analysis, data flow diagrams, extending DFD to real time systems, Object oriented design, Graphical representation of OOD, Generic OO development paradigm.
Software Reliability and Quality Assurance: Reliability issues, Reliability metrics, reliability growth modeling, Software quality, ISO 9000 certification for software industry, SEI capability maturity model, comparison between ISO & SEI CMM

Books Recommended:

1. Roger S. Pressman : **Software Engineering, A practitioner's Approach,** *McGraw-Hill*
2. Ian Sommerville : **Software Engineering**, *Pearson Education.*
3. Richard Fairley : **Software Engineering Concepts**, *McGraw-Hill.*
4. Robert N. Charette : **Software Engineering Environments,** *McGraw-Hill.*
5. S. L. Pfleeger and J.M. Atlee : **Software Engineering Theory and Practice**, *Pearson Education.*

CSE371: Software Engineering Lab

100 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on **CSE370**

CSE378: Project III

100 Marks [35% Internal Examiner, 35% External Examiner, 30% Presentation and Oral Examination]
2 Credit, 52 Contact hours

Projects must possess innovative ideas which reflect contemporary IT trends. Supervisor have to ensure that every accepted project contain basic level of research work. Projects that meet the software/hardware requirements of national and international issues are highly preferable. Students have to give a presentation on their project works. Departments should take appropriate steps to archive all the projects and keep tracks to maintain the genuineness of the projects.

CSE400: Parallel Processing and Distributed System

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
3 Credits, 39 Contact hours, Exam. Time: 4 hours

Introduction: Trends towards parallel processing, Parallel processing mechanism, Multiprogramming and Time sharing, Parallel Computer Structures, Parallelism and Pipelining, Parallel processing applications, Speedup Performance Laws, Parallel Random Access Machines (PRAM) and VLSI model.
Hardware Technology: Advanced processor Technology, Superscalar and Vector processor, Shared memory organization, Design of Linear and Non linear Pipeline processor, Multiprocessor System Interconnects.
Pipelining and Vector Processing: Principles of Pipelining, Classification of pipelined processors, Instruction and Arithmetic pipeline design, Vector Processing principles, Vector processing requirements, Designing Pipelined processors, Compound Vector processing, Recent Vector processors, Vectorization and Optimization methods.
Parallel Programming: Parallel Programming models, Parallel Languages and Compilers, Code Optimization and Scheduling, Loop Parallelization and Pipelining, Parallel Programming Environments, Shared-variable program structures, mapping programs onto Multicomputers.

Distributed Processing: Introduction, Function distribution, Hierarchical and Horizontal distributed system, Strategies for distributed data processing, Data distribution, Conflict analysis, Distributed Database and applications. Transaction and distributed transaction, concurrency control, security in distributed system.

Books Recommended:

1. Kai Hwang (Senior Consulting Edition) : **Advanced Computer Architecture Parallelism, Scalability, Programmability**, *McGraw Hill.*
2. Kai Hwang, Faye A. Briggs : **Computer Architecture and Parallel Processing**, *McGraw Hill*
3. R. J. Cypser : **Communication Architecture for distributed system**, *Addison-Wesley*.
4. James Martin : **Design and Strategy for distributed data processing**, *Prentice Hall*.

CSE401: Parallel Processing and Distributed System Lab

100 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on **CSE400**

CSE402: Computer Simulation and Modeling

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
3 Credits, 39 Contact hours, Exam. Time: 4 hours

Simulation methods: Introduction to Simulation, Random number generator, analogue simulation of continuous system, Discrete system simulation, Simulation of a pert network, Statistical analysis of result, Validation and verification techniques, Application of simulation to problems e.g. business, operation research, operating system, Computer design, Introduction to simulation packages, Computer animation.

Modelling: Introduction to modelling techniques, Problems, models and systems, Modelling concepts, Logic for (conceptual) modelling, Logic programming for conceptual modelling, Concepts of relational modelling and its practice. Some practical modelling e.g. Relational Database modelling, Different methods for Curves and surface modelling, Fractals, Polyhedral modelling with Euler's formula, Advanced modelling, Procedural models. Case Study: Simulation and Modelling software: SimScript.

Books Recommended:

1. J. A. Spriet : **Computer Aided Modelling & Simulation,** *Academic Press, Inc. Orlando, FL, USA.*
2. Richard Lehman : **Computer Simulation and Modeling,** *Lawrence Erlbaum Associates Publishers.*
3. G. Cordon : **System Simulation,** *Prentice Hall*
4. James D. Foley Andries van Dam : **Computer Graphics,** *Addison-Wesley*.

CSE403: Computer Simulation and Modeling Lab

100 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on **CSE402**

CSE410: Digital Signal Processing

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
3 Credits, 39 Contact hours, Exam. Time: 4 hours

Introduction: signals, systems and signal processing, classification of signals, the concept of frequency in continuous time and discrete time signals, analog to digital and digital to analog conversion, Sampling and quantization.
Discrete time signals and systems: Discrete time signals, discrete time systems, analysis of discrete time linear time invariant systems. Discrete time systems described by difference equations, implementation of discrete time systems, correlation and convolution of discrete time signals.
The z-transform: Introduction, definition of the z-transform, z-transform and ROC of infinite duration sequence, properties of z-transform inversion of the z-transform, the one-sided z-transform.

Frequency analysis of signals and systems: Frequency analysis of continuous time signals, Frequency analysis of discrete time signals, Properties of Fourier transform of discrete time signals, Frequency domain characteristics of linear time invariant system, linear time invariant systems as frequency selective filters, Inverse systems and deconvolution.
The Discrete Fourier Transform: The DFT, Properties of the DFT, Filtering method based on the DFT, Frequency analysis of signals using the DFT.
Fast Fourier Transform Algorithms: FFT algorithms, applications of FFT algorithm.
Digital Filters: Design of FIR and IIR filters.
Adaptive filters: Adaptive system, kalman filters, RLS adaptive filters, the steepest-descent method, the LMS filters.
Application of DSP: Speech processing, analysis and coding, Matlab application to DSP.

Books Recommended:

1. J. G. Prokis : **Digital Signal Processing**, *Prentice-hall Of India*
2. Defatta : **Digital Signal Processing,** *Wiley India Pvt Ltd*
3. R. G. Lyon : **Understanding Digital Signal Processing,** *Orling Kindersley India*
4. P. R. Babu. : **Digital Signal Processing**, *Scitech Publication.*.

CSE411: Digital Signal Processing Lab

100 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on **CSE410**

CSE412: Communication Engineering

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
3 Credits, 39 Contact hours, Exam. Time: 4 hours

Fundamentals: Communication Engineering Fundamentals, Waveforms Spectra, Periodic waveforms and its properties, Fourier series, Noise and its different types.
Amplitude Modulation: Amplitude modulation, Amplitude modulation index, Frequency spectrum for sinusoidal AM, AM broadcast Transmitter.
Frequency Modulation: Frequency Modulatio**n,** Sinusoidal FM, Frequency spectrum for Sinusoidal FM, FM transmitter. FM receiver, Phase Modulation.
Pulse modulation, Pulse Codes Modulation (PCM), Quantization, Compression, PCM Receiver, Differential PCM, Delta Modulation, Sigma-Delta A/D conversion, Pulse Frequency Modulation (PFM), Pulse Time Modulation (PTM), Pulse Position Modulation (PPM).
Digital Communication: Digital Communication, Basic Digital Communication System, Synchronization, Asynchronous Transmission, Probability of Bit Error in Base band Transmission, Matched Filter, Eye Diagrams, Digital Carrier Systems, Amplitude Shift keying, Frequency Shift Keying, Phase Shift Keying, Carrier Recovery Circuits, Differential Phase Shift Keying, Error Control Coding, Block Control, Repetition Encoding, Parity Encoding, Convolution Encoding.
Propagation: Radio Wave Propagation, Mode of Propagation, Microwave Systems, Tropospheric Propagation, VHF/UHF Radio Systems.
Satellite Communication: Satellite Communication, Kepler's First and Second Law, Orbits, Geostationary Orbits, Power System.
Fiber Optic Communication: Fiber Optic Communication, Propagation within a Fiber, Modes of Propagation, Losses in Fibers, Light sources for Fiber optics, Photodetectors.

Books Recommended:

1. Behrouz A. Forouzan : **Data Communications and Networking,** *Tata McGraw-Hill Edition*
2. William Stallings : **Data and Computer Communications**, *Prentice Hall International, Inc.*
3. John M. Senior : **Optical Fiber Communications** , *Prentice-Hall of India Pvt Ltd*
4. F. Halsall : **Data Communication, Computer Network and open systems,** *Addison Wesly*
5. Andrew S. Tanenbaum : **Computer Networks**, *Prentice Hall of India Pvt. Ltd*

CSE413: Communication Engineering Lab

100 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on CSE412

Option I should be selected from Table: I.

CSE 448 Project/Thesis

100 Marks [35% Internal Examiner, 35% External Examiner, 30% Presentation and Oral Examination]
1 Credit, 26 Contact hours

Project/Thesis work based on all major courses. Project/Thesis should be continued to the next semester with subject code CSE488.

CSE450: Artificial Intelligence

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
3 Credits, 39 Contact hours, Exam. Time: 4 hours

Introduction: History of AI - Intelligent agents – Structure of agents and its functions - Problem spaces and search - Heuristic Search techniques – Best-first search - Problem reduction - Constraint satisfaction - Means Ends Analysis.
Knowledge Representation: Approaches and issues in knowledge representation- Knowledge - Based Agent- Propositional Logic – Predicate logic – Unification – Resolution - Weak slot - filler structure – Strong slot - filler structure.
Reasoning under uncertainty: Logics of non-monotonic reasoning - Implementation- Basic probability notation - Bayes rule – Certainty factors and rule based systems-Bayesian networks – Dempster - Shafer Theory - Fuzzy Logic.
Planning and Learning: Planning with state space search - conditional planning-continuous planning - Multi-Agent planning. Forms of learning - inductive learning - Reinforcement Learning - learning decision trees - Neural Net learning and Genetic learning
AI programming languages: Introduction to PROLOG, knowledge representation, domain, predicate, clauses, database, back tracking, unification, list, and compound object using prolog.
Introduction to selected topics in AI: Neural Networks, Expert system, Robotics and Fuzzy logic

Books Recommended:

1. Elaine Rich, Kevin Knight and Shivashankar B.Nair : **Artificial Intelligence,** *Tata McGraw-Hill*
2. Staurt J. Russel and Peter Norvig : **Artificial Intelligence: A modern Approach**, *Pearson Education Asia*
3. D. W. Patterson : **Introduction to Artificial Intelligence and Expert System,** *Prentice-Hall of India*
4. Patrick Henry Winston : **Artificial intelligence**, *Pearson Education Inc.*
5. N. P. Padhy : **Artificial Intelligence and Intelligent System**, *Oxford University Press*
6. Carl Townsend : **Introduction to Turbo Prolog,** *Sybex Inc.*
7. Bratko, I : **Prolog Programming for Artificial Intelligence, Addison Wesley**
8. Clocksin, W.F. and Mellish, C.S. : **Programming in Prolog: Using the ISO Standard**, *Springer.*

CSE451: Artificial Intelligence Lab

100 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on **CSE450**

CSE452: Digital Image Processing

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
3 Credits, 39 Contact hours, Exam. Time: 4 hours

Introduction and Fundamental to Digital Image Processing: What is Digital Image Processing, Origin of Digital Image Processing, Examples that use Digital Image Processing, Fundamental steps in Digital Image

Processing, Components of Digital Image Processing System, Image sensing and acquisition, Image sampling, quantization and representation, Basic relationship between pixels.
Image Enhancement in the Spatial Domain & Frequency domain: Background, Basic gray level transformation, Histogram processing, Basics of spatial filtering, Smoothing and Sharpening Spatial filters, Introduction to Fourier Transform and the Frequency Domain, Discrete Fourier Transform. Smoothing and Sharpening Frequency-Domain filters.
Image Restoration: Image Degradation/Restoration Process, Noise models, Restoration in presence of noise, Inverse Filtering, Minimum Mean Square Filtering, Geometric mean filter, Geometric transformations.
Color Image Processing: Color Fundamentals, Color models, Basis of full color image processing, Color transformations.
Image Compression: Fundamentals, Image compression models, Error free compression, Lossy compression.
Morphological image processing: Preliminaries, Dilations and Erosion, opening and closing, Some basic morphological algorithms.
Image Segmentation: Detection of Discontinuities, Edge linking and boundary detection, Thresholding, Region oriented segmentation.
Representation, Description and Recognition: Representation-chain codes, polygonal approximation and skeletons, Boundary descriptors-simple descriptors, shape numbers, Regional descriptors- simple, topological descriptors, Pattern and Pattern classes-Recognition based on matching techniques.

Books Recommended:

1. Rafeal C. Gonzalez & Richard E. Woods : **Digital Image Processing,** *Prentice-Hall Publication*
2. A. K. Jain : **Fundamentals of Digital Image Processing,** *Academic Press.*
3. Mark S. Nixon & Albert S. Aguado : **Feature Extraction and Image Processing**, *Academic Press*
4 William K. Pratt : **Digital Image Processing**, *Wiley-Interscience,*

CSE453: Digital Image Processing Lab

100 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on **CSE452**

Option II and III should be selected from Table: II.

CSE488: Project/Thesis

100 Marks [35% Internal Examiner, 35% External Examiner, 30% Presentation and Oral Examination]
3 Credits, 78 Contact hours

CSE489: Board viva-voce

100 Marks [100% Viva-voce] 2 Credits

Board viva-voce will be conducted by Examination Committee.

Option I should be selected from the following courses.

CSE420: Design of VLSI Circuits and Systems

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
3 Credits, 39 Contact hours, Exam. Time: 4 hours

VLSI design methodology: top-down design approach, technology trends.
MOS technology: Introduction to MOS technology, operation of MOS transistor as a switch and amplifier, MOS, NMOS, CMOS inverters, pass transistor and pass gates, DC and transient characteristics.
Overview of fabrication process: NMOS, CMOS, Bi-CMOS process.
NMOS and CMOS layout: Stick diagram, and design rules.
CMOS circuit characteristics: Resistance and capacitance, rise and fall time, power estimation.

Introduction to Bi-CMOS circuits: Shifter, adder, counter, multipliers. Data Path and memory structures, Buffer circuit design.
Design style: FPGA and PLDs.

Books Recommended:

1. K. Eshraghian & D. A. Pucknell : **Basic VLSI design: System & Circuit**, *Prentice-Hall*
2. R. K. Brayton : **Logic Minimization Algorithms for VLSI Synthesis**, *Kluwer Academic Publishers Norwell, MA, USA.*
3. F. Lombardi and M. G. Sami : **Testing and Diagnosable Design of VLSI and ULSI,** *Springer.*
4. C. A. Mead and L. A. Conway : **Introduction to VLSI Systems**, *Addison-Wesley*.

CSE421: Design of VLSI Circuits and Systems Lab

100 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on **CSE420**

CSE422: Computer Peripherals and Interfacing

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
3 Credits, 39 Contact hours, Exam. Time: 4 hours

Basic concepts of microprocessor interfacing: reviews of address decoding concepts, Input and Output port design, decoder, encoder, mutliplexer, demultiplexer.
Interfacing peripherals: Peripheral I/O and memory mapped I/O, Interfacing with external memory, microprocessor controlled data transfer anfd peripheral controlled data transfer, Peripheral I/O instruction for Intel 8085 Microprocessor and its timing diagram. Interfacing with LED, seven segment display, Push-button keys, Matrix keyboard, AD and DA converter.
Programmable Interface device: 8212, Programmable devices with Handshake signals, 6155/8156 multipurpose programmable devices, Interfacing seven segment LED using 8155, 8155 timer, 8155 I/O ports in Handshake modes and its interfacing example, Interfacing 8355/8755 Programmable I/O ports, 8279 programmable keyboard/display interface and its interfacing example, 8255 Programmable peripheral interface, Block diagram of 8255, its different mode of operation, Interfacing A/D converter using 8255, Application of 8255 in Handshake mode, 8253 Programmable interval timer, programming 8263, 8253 as counter, 8259 programmable interrupt controller and its priority mode and other features, programming the 8259, 8257 DMA controller and its block diagram, example of application of 8257 DMA controller.
Serial I/O and data communication: Synchronous and asynchronous transmission, Parity check, BAUD, RS 232 standard, Software versus programmable hardware approach, software controlled asynchronous serial I/O, 8085 serial I/O SOD and SID, Hardware controlled serial I/O using programmable chips, 8251 programmable communication interface and its block diagram, interfacing RS 232 Terminal using the 8251A.
Micro-Controllers: Applications for the interfacing with Computers, stand-alone application of micro-controller.

Books Recommended:

1. Rafiquzzaman : **Microprocessor and Microcomputer based System Design,** *CRC-Press*
2. D. V. Hall : **Microprocessors and Interfacing**, *McGraw-Hill*
3. Y. Liu and G. A. Gibson : **Microcomputer Systems: 8086/8088 Family**, *Prentice-Hall*
4. Artwick : **Microcomputer Interfacing**, *Prentice Hall.*
5. James E. Powell : **Designing User Interfaces**, *Microtrend Books San Marcos, CA, USA*

CSE423: Computer Peripherals and Interfacing Lab

100 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on **CSE422**

CSE430: Web Engineering

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
3 Credits, 39 Contact hours, Exam. Time: 4 hours

Introduction: Introduction to Web Engineering, Requirements Engineering and Modeling Web Applications, Web Application Architectures, Technologies and Tools for Web Applications, SEO

E-Commerce : E-Commerce Definition, Internet History and E-Commerce Development, Business-to-Business E-Commerce, Business-to-Consumer E-Commerce, E-Commerce Stages and Processes, E-Commerce Challenges, E-Commerce Opportunities, internet Access Requirements, Web Hosting Requirements, Entry-Level Options, Storefront and Template Services, E-Commerce Software Packages, E-Commerce Developers, E-Business Solutions.
Payment Processing: Electronic Payment Issues, E-Cash, Credit Card Issues, Merchant Accounts, Online Payment Services, Transaction Processing
Mobile Commerce: Over view of M-Commerce, advantages and limitations, WML,
Security Issues: Security Issues and Threats, Security Procedures, Encryption, Digital Certificates, SSL and SET Technologies, Authentication and Identification, Security Providers, Privacy Policies.
The WWW: HTTP protocol, HTML, XHTML, XML, JavaScript, CSS, DOM, Types of object in DOM architecture, XML object, DOM and JavaScript.
Web Services: Web 2.0 and Web 3.0 Services.

Books Recommended:

1. Gerti Kappel, Birgit Pröll, Siegfried Reich, Werner Retschitzegger : **Web Engineering: The Discipline of Systematic Development of Web Applications**
2. Roger Pressman, David Lowe : **Web Engineering: A Practioner's Approach**
3. Elias M. Awad : **Electronic Commerce: From Vision to Fulfillment**, *Prentice-Hall Inc.*
4. Jeffrey F., Rayport, Bernard J. Jaworsk : **E-Commerce,** *McGraw-Hill*
5. David Kosiur : **Understanding Electronic Commerce**, *Microsoft Press*.
6. Jeffrey F. Rayport, et al. : **Introduction to E-Commerce**, *McGraw-Hill.*
7. Debra Cameron : **E-Commerce Security Strategies: Protection the Enterprise**, *Computer Technology Research Corp*
8. Charles Trepper : **E-Commerce Strategies**, *Phi Learning Pvt. Ltd*

CSE431: Web Engineering Lab

100 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on **CSE430**

CSE432: Computational Geometry

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
3 Credits, 39 Contact hours, Exam. Time: 4 hours

Introduction: historical perspective, geometric preliminaries. Convex hulls algorithms in 2d and 3d, lower bounds.
Triangulations: polygon triangulations, representations, point-set triangulations, planar graphs;
Voronoi diagrams: construction and applications, variants;
Delayney triangulations: divideand- conquer, flip and incremental algorithms, duality of Voronoi diagrams, min-max angle properties;
Geometric searching: pointlocation, fractional cascading, linear programming with prune and search, finger trees, concatenable queues, segment trees, interval trees;
Visibility: algorithms for weak and strong visibility, visibility with reflections, art-gallery problems;
Arrangements of lines: arrangements of hyperplanes, zone theorems, many-faces complexity and algorithms;
Combinatorial geometry: Ham-sandwich cuts, Helly's theorems, k-sets, polytopes and hierarchies, polytopes and linear progarmming in d-dimensions, complexity of the union of convex sets, simply connected sets and visible regions;
Sweep techniques: plane sweep for segment intersections, Fortune's sweep for Voronoi diagrams, topological sweep for line arrangements;
Randomization in computational geometry: algorithms, techniques for counting; Robust geometric computing; Applications of computational geometry.

Books Recommended:

1. M. d. Berg, O. Schwarzkopf, M. v. Kreveld and M. Overmars : **Computational Geometry: Algorithms and Applications**, *Springer*.

2. F. P. Preparata and M. I. Shamos : **Computational Geometry: An Introduction**, *Springer*.
3. J. O. Rourke : **Computational Geometry in C**, *Cambridge University Press*.

CSE433: Computational Geometry Lab

100 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on **CSE432**

Option II and III should be selected from the following courses.

CSE460: Distributed Database Management System

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
3 Credits, 39 Contact hours, Exam. Time: 4 hours

Introduction: Distributed Data processing, Distributed database system (DDBMSS), Promises of DDBMSs, Complicating factors and Problem areas in DDBMSs, Overview Of Relational DBMS Relational Database concepts, Normalization, Integrity rules, Relational Data Languages, Relational DBMS
Distributed DBMS Architecture: DBMS Standardization, Architectural models for Distributed DBMS, Distributed DBMS Architecture Distributed Database Design: Alternative design Strategies, Distribution design issues, Fragmentation, Allocation. Semantic Data Control: View Management, Data security, Semantic Integrity Control
Overview Of Query Processing: Query processing problem, Objectives of Query Processing, Complexity of Relational Algebra operations, characterization of Query processors, Layers of Query Processing Introduction To Transaction Management: Definition of Transaction, Properties of transaction, types of transaction
Distributed Concurrency Control: Serializability theory, Taxonomy of concurrency control mechanisms, locking bases concurrency control algorithms. Parallel Database Systems: Database servers, Parallel architecture, Parallel DBMS techniques, Parallel execution problems, Parallel execution for hierarchical architecture.
Distributed Object Database Management systems: Fundamental Object concepts and Object models, Object distribution design. Architectural issues, Object management, Distributed object storage, Object query processing. Transaction management. Database Interoperability: Database Integration, Query processing,

Books Recommended:

1. M.T. Ozsu and P. Valduriez : **Principles of Distributed Database Systems,** *Pearson.*
2. S. Ceri and G. Pelagatti : **Distributed Databases principles and systems,** *Tata McGraw Hill*
3. Andrew S. Tanenbaum : **Distributed Database,** *Pearson*.

CSE461: Distributed Database Management System

100 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on **CSE460**

CSE462: Cryptography and Network Security

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
3 Credits, 39 Contact hours, Exam. Time: 4 hours

Cryptography:
Overview: Cryptography Overview and Terminologies.
Symmetric Ciphers: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Steganography, Simplified DES, Block Cipher Principles, The Data Encryption Standard, The Strength of DES, Block Cipher Design Principles, Evaluation Criteria for AES, The AES Cipher, Triple DES, Blowfish, RC5, Characteristics of Advanced Symmetric Block Ciphers, RC4 Stream Cipher, Placement of Encryption Function, Traffic Confidentiality, Key Distribution.
Public-Key Encryption: Principles of Public-Key Cryptosystems, The RSA Algorithm, Key Management.
Network Security:

Message Authentication: Authentication Requirements, Authentication Functions, Message Authentication Codes, Hash Functions, MD5 Message Digest Algorithm, Secure Hash Algorithm, Digital Signatures, Authentication Protocols.
Network Security Practice: Kerberos, Pretty Good Privacy, S/Mime, IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Web Security Considerations, Secure Socket Layer and Transport Layer Security.
System Security: Intruders, Intrusion Detection, Password Management, Viruses and Related Threats, Virus Countermeasures, Firewalls.

Books Recommended:

1.	W. Stallings	:	**Cryptography and Network Security Principles and Practice**, *Prentice Hall.*
2	Behrouz Forouzan		**Cryptography and Network Security**, *McGraw-Hill*
3.	Bruce Schneier	:	**Applied Cryptography**, *John Wiley & Sons.*
4.	Dieter Gollmann	:	**Computer Security**, *John Wiley and Son.*
5.	Edward Amoroso	:	**Fundamentals of Computer Security Technology**, *Prentice Hall.*
6.	E. Biham and A. Shamir	:	**Differential Crypt Analysis of the Data Encryption Standard,** *Springer Verlag.*
7.	D. Denning	:	**Cryptography and Data Security,** *Addison Wesley*.
8.	N. Kobliz	:	**A Course on Number Theory and Cryptography,** *Springer Verlag*.

CSE463 Cryptography and Network Security Lab

100 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on **CSE462**

CSE470: Pattern Recognition

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
3 Credits, 39 Contact hours, Exam. Time: 4 hours

Basics of pattern recognition: Introduction to pattern recognition, feature extraction, and classification.
Bayesian decision theory: Classifiers, Discriminant functions, Decision surfaces, Normal density and discriminant functions, Discrete features
Parameter estimation methods: Maximum-Likelihood estimation, Gaussian mixture models, Expectation-maximization method, Bayesian estimation
Hidden Markov models for sequential pattern classification: Discrete hidden Markov models, Continous density hidden Markov models, Viterbi algorithm, Baum-Welch algorithm
Dimension reduction methods: Principal component, Fisher discriminant analysis analysis
Non-parametric techniques for density estimation: Parzen-window method, K-Nearest Neighbour method
Linear/non-inear discriminant function based classifiers: Multi-layer Perceptrons, Support vector machines
Non-metric methods for pattern classification: Non-numeric data or nominal data,Decision trees
Unsupervised learning and clustering: Criterion functions for clustering, Algorithms for clustering: K-means, Hierarchical and other methods, Cluster validation

Books Recommended:

1.	R.O.Duda, P.E.Hart and D.G.Stork	:	**Pattern Classification**, *John Wiley*
2.	S.Theodoridis and K.Koutroumbas	:	**Pattern Recognition**, *Academic Press*
3.	C.M.Bishop	:	**Pattern Recognition and Machine Learning**, *Springer*
4.	E.G. Richard, Johnsonbaugh and S. Jost	:	**Pattern Recognition and Image Analysis,** *Prentice Hall of India Private Ltd., NewDelhi*

CSE471: Pattern Recognition Lab

100 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on **CSE470**

CSE472: Multimedia System and Virtual Environment

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
3 Credits, 39 Contact hours, Exam. Time: 4 hours

Multimedia systems: introduction; Coding and compression standards; Architecture issues in multimedia.
Operating systems issues in multimedia: real-time OS issues, synchronization, interrupt handling. **Database issues in multimedia:** indexing and storing multimedia data, disk placement, disk scheduling, searching for a multimedia document.
Networking issues in multimedia: Quality-of-service guarantees, resource reservation, traffic specification, haping and monitoring, admission control; Multicasting issues; Session directories; Protocols for controlling sessions;
Security issues in multimedia: digital water-marking, partial encryption schemes for video streams.
Multimedia applications: audio and video conferencing, video on demand, voice over IP.
Networked virtual environment(NVE): Networked virtual environment overview; forms of distributed interaction; example systems; NVE technologies and challenges; origins of NVE.

Books Recommended:

1. Ze-Nian Li and Mark S. Drew : **Fundamentals of Multimedia**, *Pearson*
2. John Villamil-Casanova and Louis Molina : **Multimedia: An Introduction**, *Prentice Hall India.*
3. Tay Vaughan : **Multimedia: Making It Work**, *McGraw-Hill*
4. John Villamil-Casanova and Leony Fernandez-Elias : **Multimedia: Graphics,** *Prentice Hall India.*
5. **Jose Lozano**, **Louis Molina** and **John Willif** : **Multimedia Sound and Video**, *Prentice Hall India.*

CSE473: Multimedia System and Virtual Environment Lab

100 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on **CSE472**

CSE480: Wireless Communication

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
3 Credits, 39 Contact hours, Exam. Time: 4 hours

BLUE TOOTH: applications , Architecture of a Bluetooth system , Transfer methods , Frequences , Bluetooth hardware, Implementation variants , Data transfer , Asynchronous links , Synchronous links , Packages , Base band, Link manager , Host controller , Security , L2CAP , Service Discovery Protocol , Telephony Control Protocol , RFCOMM , Audio, OBEX , IrMC/SyncML , TCP/IP, PPP, Profiles , Object Push , Handsfree.

Mobile Technology: Generation of Mobile Technology, Overview GSM, CDMA, FDMA, TDMA, 2G+ Technology, GPRS, HSCSD, EDGE, ECSD, EGPRS, 3G Technology. Mobile communication (GSM, CDMA) Architecture, Cellular principle, Mobile Station (MS), Base Station Subsystem (BSS) BTS, BSC, XCDR/TRAU, Network Switching Subsystem (NSS) HLR, VLR, AuC, EIR, Operation and Maintenance Subsystem (OMS) UMS, WAP, INS, C&LBS, Enhanced Services Subsystem (ESS), Billing and Customer Care System (B&CCS).

WiMax: WiMAX, WiMAX Metrics, WiMAX Family of Standard, Fixed WiMAX Standards, Mobile WiMAX Standards, WiMAX Protocol Layers, WiMAX Physical Layer Operation, WiMAX MAC Layer Operations, WIMAX RF Optimization, WiMAX Problems, Economics of WiMAX, WiMAX Regulatory Issues, WiMAX Competition, WiMAX Planning, Coverage and Capacity, WiMAX Future Trends.

WiFi: Principles and Operation , Metropolitan WiFi Network Design and Deployment , Technology, Applications, Design, and Deployment , Wi-Fi Network Security , Wireless 802.xx Networks Overview, 802.11 Wireless LAN Trends and Technologies , Wireless LANs Security Fundamentals.

Wireless Sensor Network: Wireless Sensor Network Overview, Application of WSN, Characteristics of WSN, Standard and Specification of WSN, WirelessHART, ISA100, IEEE 1451, ZigBee / 802.15.4, WSN Operating System(Overview only) eCos or uC/OS, TinyOS, LiteOS, WSN Simulator (Overview only) QualNet, NetSim, NS2, Distributed sensor network, Limitation, Future Trend.

Books Recommended:

1.	Erricson	:	**GSM System Survey** , *Erricson*
2.	Matthew Gast, Matthew S. Gast	:	**802.11 Wireless Networks: The Definitive Guide**, *O'Reilly Networking.*
3.	Frank Ohrtman	:	**WiMAX Handbook: Building 802.16 Networks**, *McGraw-Hill*
4.	Kazem Sohraby, Daniel Minoli, Taieb Znati	:	**Wireless Sensor Networks: Technology, Protocols, and Applications,** *WILLAY.*

CSE481: Wireless Communication Lab

100 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on **CSE480**

CSE490: Machine Learning

100 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
3 Credits, 39 Contact hours, Exam.Time: 4 hours

Intro & Basics: The concept learning task, Goals and applications of machine learning. Aspects of developing a learning system, Version Spaces, Parameter Estimation.
Supervised Learning/Classification:
Linear Classifiers: Linear Regression, Logistic Regression, Naive Bayes, Overfitting, Bias-Variance Trade-off, Discriminitive vs. Generative Models.
Non-linear Classifiers: Decision Trees; Artificial Neural Networks: Linear threshold units, Perceptrons, Multilayer networks and backpropagation, recurrent networks; k-Nearest Neighbor.
Margin-based Approaches: Support Vector Machines (SVMs)
Computational Learning Theory: Sample Complexity, Probably Approximately Correct (PAC) learning, Vapnik-Chervonenkis (VC) Dimension
Unsupervised Learning/Clustering: Hierarchical Agglomerative Clustering, K-means, Spectral Methods, EM.
Density Estimation via Structured Models: Graphical Models, Bayesian Networks, Markov Random Field
Ensemble learning: boosting, bagging; Hidden Markov Models, Reinforcement Learning.

Books Recommended:

1.	R.O. Duda, P.E. Hart, D.G. Stork	:	**Pattern Classification**, *Wiley & Sons, Inc., New York*
2.	S. Theodoridis, K. Koutroumbas,	:	**Pattern Recognition**, *Academic Press*
3.	C.M. Bishop	:	**Pattern recognition & Machine Learning**, *Springer Science+Bussiness Media, LLC, New York.*
4.	T. Hastie, R. Tibshirani & J. Friedman	:	**The Elements of Statistical Learning: Data Mining, Inference, and Prediction**, *Springer*
5.	Tom Mitchell	:	**Machine Learning**, *McGraw-Hill.*

CSE491: Machine Learning Lab

100 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on **CSE490**