CSE COURSE STRUCTURE **SEMESTER-I**

SL. NO.	PAPER CODE	PAPER NAME	L	T	P	CONTACT HRS./WEEK	CREDIT
THEORY							
01.	HS101	ENGLISH FOR COMMUNICATION	2	1	0	3	2
02.	BS101	MATHEMATICS-I	3	1	0	4	3
03.	BS102	ENGINEERING PHYSICS-I	3	1	0	4	3
04.	BS103	ENGINEERING CHEMISTRY	3	1	0	4	3
05.	ES101	MECHANICAL SCIENCES-I	3	1	0	4	3
06.	ES102	BASIC ELECTRICAL ENGG.	3	1	0	4	3
PRACTICAL							
07.	BS112	PHYSICS LAB-I	**0**	**0**	**3**	**3**	**2**
08.	BS113	CHEMISTRY LAB	0	0	3	3	2
09.	ES111	ENGG. WORKSHOP	0	0	4	4	3
10.	ES112	BASIC ELETRICAL ENGG. LAB	0	0	3	3	2
		TOTAL	17	06	13	36	26
11.	**MC101**	NSS	0	0	3	3	2

SEMESTER-II

SL. NO.	PAPER CODE	PAPER NAME	L	T	P	CONTACT HRS./WEEK	CREDIT
THEORY							
01.	BS204	MATHEMATICS-II	3	1	0	4	3
02.	BS205	ENGINEERING PHYSICS-II	3	1	0	4	3
03.	ES203	MECHANICAL SCIENCES-II	3	1	0	4	3
04.	ES204	BASIC ELETRONICS ENGG.	3	1	0	4	3
05.	ES205	INTRODUCTION TO COMPUTER PROG.	3	1	0	4	3
PRACTICAL							
06.	BS215	PHYSICS LAB-II	**0**	**0**	**3**	**3**	**2**
07.	ES213	ENGINEERING DRAWING & GRAPHICS	0	0	3	3	2
08.	ES214	BASIC ELECTRONICS ENGG. LAB	0	0	3	3	2
08.	ES215	COMPUTER PROG. LAB	0	0	3	3	2
09.	HS212	LANGUAGE LAB	0	0	3	3	2
		TOTAL	15	05	15	35	25
10.	MC202	ENVIRONMENTAL SCIENCES	3	0	0	3	3

SEMESTER-III

SL. NO.	PAPER CODE	PAPER NAME	L	T	P	CONTACT HRS./WEEK	CREDIT
THEORY							
01.	BS(CS)306	PROBABILITY AND STATISTICS	3	1	0	4	3
02.	CS 301	NUMERICAL METHODS	2	1	0	3	2
03.	CS302	DIGITAL LOGIC	3	1	0	4	3
04.	CS303	COMPUTER ORGANIZATION	3	1	0	4	3
05.	CS304	DATA STRUCTURE & ALGORITHM	3	1	0	4	3
PRACTICAL							
06.	CS391	NUMERICAL METHODS LAB	0	0	3	3	2
07.	CS392	DIGITAL LOGIC LAB	0	0	3	3	2
08.	CS393	COMPUTER ORGANIZATION LAB	0	0	3	3	2
09.	CS394	ALGORITHMS-I LAB	0	0	3	3	2
		TOTAL	14	5	12	31	22
10.	MC303	VALUE EDUCATION, HUMAN RIGHTS	3	0	0	3	3

SEMESTER-IV

SL. NO.	PAPER CODE	PAPER NAME	L	T	P	CONTACT HRS./WEEK	CREDIT
THEORY							
01.	BS 407	ELEMENTARY BIOLOGY	3	0	0	3	3
02.	CS405	GRAPH THEORY & COMBINATORICS	3	1	0	4	3
03.	CS406	COMMUNICATION ENGINEERING	3	0	0	3	3
04.	CS407	MICROPROCESSOR & ITS INTERFACING	3	1	0	4	3
05.	CS408	FORMAL LANGUAGE & AUTOMATA THEORY	3	1	0	4	3
PRACTICAL							
06.	CS495	SOFTWARE TOOLS LAB	0	0	3	3	2
07.	CS496	COMMUNICATION ENGINEERING LAB	**0**	**0**	**3**	**3**	**2**
08.	CS497	MICROPROCESSOR LAB	0	0	3	3	2
09.	CS498	ALGORITHMS – II LAB	0	0	3	3	2
		TOTAL	15	3	12	30	23

SEMESTER-V

SL. NO.	PAPER CODE	PAPER NAME	L	T	P	CONTACT HRS./WEEK	CREDIT
THEORY							
01.	CS509	DATA BASE MANAGEMENT SYSTEMS	3	1	0	4	3
02.	CS510	COMPUTER ARCHITECTURE	3	1	0	4	3
03.	CS511	OPERATING SYSTEM	3	1	0	4	3
04.	CS512	OBJECT ORIENTED METHODOLOGIES	3	1	0	4	3
05.	PE(CS)501	A. ARTIFICIAL INTELLIGENCE B. IMAGE PROCESSING C. SOFT COMPUTING D. VLSI DESIGN & ALGORITHMS	3	0	0	3	3
PRACTICAL							
06.	CS599	DATA BASE MANAGEMENT SYSTEMS LAB	0	0	3	3	2
07.	CS591	OPERATING SYSTEM LAB	0	0	3	3	2
08.	CS592	PROGRAMME PRACTICES LAB USING C++	0	0	3	3	2
09.	PE(CS)591	A. ARTIFICIAL INTELLIGENCE LAB B. IMAGE PROCESSING LAB C. SOFT COMPUTING LAB D. VLSI LAB	0	0	3	3	2
		TOTAL	15	4	12	31	23

SEMESTER-VI

SL. NO.	PAPER CODE	PAPER NAME	L	T	P	CONTACT HRS./WEEK	CREDIT
THEORY							
01.	HS(CS)603	MANAGEMENT PRINCIPLES AND PRACTICES	3	0	0	3	2
02.	CS613	COMPUTER NETWORK	3	1	0	4	3
03.	CS614	SOFTWARE ENGINEERING	3	1	0	4	3
04.	CS615	DESIGN & ANALYSIS OF ALGORITHM	3	1	0	4	3
05.	CS616	COMPILER DESIGN	3	1	0	4	3
PRACTICAL							
06.	CS693	COMPUTER NETWORK LAB	0	0	3	3	2
07.	CS694	SOFTWARE ENGINEERING LAB	0	0	3	3	2
08.	CS695	JAVA PROGRAMMING LAB	0	0	3	3	2
09.	CS696	SEMINAR ON PROPOSED PROJECT	0	0	3	3	2
		TOTAL	15	4	12	31	22
10.	MC604	TECHNICAL COMMUNICATION AND SOFT SKILLS	0	0	3	3	3

SEMESTER-VII

SL. NO.	PAPER CODE	PAPER NAME	L	T	P	CONTACT HRS./WEEK	CREDIT
THEORY							
01.	PE(CS)702	A. INTERNET & WEB PROGRAMMING B. SYSTEM SOFTWARE & ADMINISTRATION C. MULTIMEDIA COMPUTING D. E-COMMERCE	3	0	0	3	3
02.	PE(CS)703	A. DISTRIBUTED COMPUTING SYSTEMS B. CLOUD COMPUTING C. NETWORKING APPLICATIONS & SERVICES D. DATA WAREHOUSING AND DATA MINING E. SENSOR NETWORKS F. BIO-MEDICAL ENGINEERING G. COMPUTATIONAL GEOMETRY	3	0	0	3	3
03.	PE(CS)704	A. INFPRMATION & CODING THEORY B. ERP C. COMPUTER GRAPHICS AND VISUALIZATION D. SIMULATION & MODELLING E. EMBEDED SYSTEMS	3	0	0	3	3
03.	OE(CS)701	A. CIRCUIT THEORY & NETWORK B. DIGITAL SIGNAL PROCESSING C. INDUSTRIAL CONTROL SYSTEMS E. ENGINEERING SYSTEM ANALYSIS & DESIGN	3	1	0	4	3
PRACTICAL							
05.	OE(CS)792	A. WEB PROGRAMMING LAB B. SYSTEM ADMINISTRATION LAB C. MULTIMEDIA LAB D. E-COMMERCE LAB	0	0	3	3	2
06.	OE(CS)791	A. CIRCUIT THEORY & NETWORK LAB B. DIGITAL SIGNAL PROCESSING LAB C. CONTROL SYSTEMS LAB E. ENGINEERING SYSTEM ANALYSIS & DESIGN LAB					
07.	HS714	GROUP DISCUSSION	**0**	**0**	**2**	**2**	**2**
08.	CS720	INDUSTRIAL TRAINING (4 WEEKS AFTER 6TH SEM	0	0	0	0	2
09.	CS721	PROJECT PART - I	0	0	6	6	3
		TOTAL	12	2	14	28	24

SEMESTER-VIII

SL. NO	PAPER CODE	PAPER NAME	L	T	P	CONTACT HRS./WEEK	CREDIT
THEORY							
01.	PE(CS)805	A. MOBILE COMPUTING B. ADVANCED WEB TECHNOLOGY C. CRYPTOGRAPHY & INFORMATION SECURITY D. PATTERN RECOGNITION E. NATURAL LANGUAGE PROCESSING F. COMPUTER VISION G. GIS & REMOTE SENSING	3	0	0	3	3
02.	OE(CS)802	A. PROJECT MANAGEMENT B. ROBOTICS C. REAL TIME OPERATING SYSTEMS D. KNOWLEDGE MANAGEMENT E. CYBER LAW & SECURITY POLICY F. OPTICAL NETWORKING	3	0	0	3	3
03.	OE(CS)803	A. OPERATION RESEARCH B. HUMAN RESOURCE MANAGEMENT C. GAME THEORY & ENGG APPLICATIONS D. ENGG SYSTEM DESIGN OPTIMIZATION E. FINANCIAL MANAGEMENT	3	0	0	3	3
PRACTICAL							
04.	CS822	PROJECT PART -II	0	0	12	12	6
05.	CS823	COMPREHENSIVE VIVA VOCE	0	0	0	0	2
		TOTAL	09	0	12	21	17

CSE 3rd sem detail syllabus

Subject Name: DIGITAL LOGIC
Code: CS 302
Contacts: 3L + 1T = 4
Credits: 3

Module - 1: [8L]

Number Systems , Boolean Algebra & Logic Gates: Binary numbers & Boolean algebra , Venn diagram, Logic gates, Truth Tables and function minimization using algebraic method, Karnaugh map, Quine- Mcclusky method; BCD, ASCII, EBDIC, Gray codes and their conversions, Signed binary number representation with 1's and 2's complement methods, Maxterm, Minterm, Representation in SOPand POS forms ; Realization of Boolean functions using NAND/NOR gates, two-level and multi-level logic circuit synthesis.

Module - 2: [10L]

Combinational circuits : Adder and Subtractor circuits (half & full adder & subtractor); Encoder, Decoder, Comparator, Multiplexer, De-Multiplexer and Parity Generator and checker; ROM, PLA .

Module - 3: [10L]

Sequential Circuits: Latch, Flip-flop. Design of Flip-flops with logic gates. Counters, Registers. Design and analysis of sequential circuits -Moore and Mealy model description, state diagram and state table – Minimization methods. Memory unit. Racing and Logic hazards. Implementation of hazard free logic circuit. asynchronous sequential circuit synthesis.

Module – 4: [10L]

Digital Integrated Circuits: Diode as switch. Use of diodes in AND, OR Circuits . Transistor as a switch. RTL, DTL, TTL logic gate circuits. MOS as a switch. Basic MOS inverter. MOS and CMOS logic gates. Fan -in and Fan-out of logic gates, propagation delay, Tristate logic.

Textbooks:

1. Digital Logic Design- Morries Mano- PHI
2. Digital Electronics - Kharate - Oxford
3. Digital Electronics - Logic & Systems by 1.Bigmell & R.Donovan; Cambridge Learning.
4. Digital Logic and State Machine Design (3rd Edition) - D.J.Comer, OUP

Reference:

5.P.Raja- Digital Electronics- Scitech Publications
6. R.P.Jain-Modern Digital Electronics, 2/e , Me Graw Hill
7.H.Taub & D.Shilling, Digital Integrated Electronics- Mc Graw Hill.
8.D.Ray Chaudhuri- Digital Circuits-Vol-I & II, 2/e- Platinum Publishers
9.Tocci, Widmer, Moss- Digital Systems,9/e- Pearson
10.J.Bignell & R.Donovan-Digital Electronics-Sle- Cenage Learning.
11.Leach & Malvino-Digital Principles & Application, Sle, Me Graw Hill
12. Floyed & Jain- Digital Fundamentals-Pearson.

Subject Name: DIGITAL LOGIC LAB
Code: CS 392
Contacts: 3P
Credits: 2

Logic family: Implementation of OR and AND gates using diodes, Study on characteristics of DTL and TTL inverters using discrete components, Study on characteristics of TTL and CMOS gates. **[12 P]**

Combinational logic circuits: Design and implementation of combinational circuits such as, Adders, comparators, parity generator and checker. Implementation of Boolean functions using multiplexer and decoder/de-multipluxer. **[12 P]**

Sequential circuits: Study of latch and flip-flop, design of counters. **[12 P]**

Subject Name: NUMERICAL METHODS
Code: CS301
Contacts: 2L+1T
Credits: 2

Approximation in numerical computation: [4 L]
Truncation and rounding errors, Fixed and floating-point arithmetic, Propagation of errors.

Interpolation: [6 L]
Newton forward/backward interpolation, Lagrange's and Newton's divided difference Interpolation. Central difference interpolation formula – Stirling and Bessels interpolation.

Numerical integration: [3 L]
Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule. Expression for corresponding error terms.

Numerical solution of a system of linear equations: [6L]
Gauss elimination method, Matrix inversion, LU Factorization method, Gauss-Seidel iterative method.

Numerical solution of Algebraic equation: [4 L]
Bisection method, Regula-Falsi method, Newton-Raphson method.

Numerical solution of ordinary differential equation: [6 L]
Euler's method, Runge-Kutta methods, Predictor-Corrector methods and Finite Difference method.

Text Books:
1. C.Xavier: C Language and Numerical Methods.
2. Dutta & Jana: Introductory Numerical Analysis.
3. J.B.Scarborough: Numerical Mathematical Analysis.
4. Jain, Iyengar , & Jain: Numerical Methods (Problems and Solution).
5. Soumen Guha & Rajesh Srivastava: Numerical Methods, OUP.
6. Balagurusamy: Numerical Methods, Scitech.

References:
1. Atkinson, Kendall E. Elementary Numerical Analysis New York, NY: John Wiley
2. N. Dutta: Computer Programming & Numerical Analysis, Universities Press.
3. Soumen Guha & Rajesh Srivastava: Numerical Methods, OUP.

4. Srimanta Pal: Numerical Methods, OUP.
5. Stoer, J. and Bulirsch, R. Introduction to Numerical Analysis New York, NY: Springer-Verlag,
6. Conte, Samuel D. and de Boor, Carl. Elementary Numerical Analysis: An Algorithmic Approach, New York, NY: McGraw-Hill,

Subject Name: NUMERICAL METHODS LAB
Code : CS 391
Contacts : 3P
Credits : 2

1. Assignments on Newton forward /backward, Lagrange's interpolation. [9 P]

2. Assignments on numerical integration using Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule. [9 P]

3. Assignments on numerical solution of a system of linear equations using Gauss elimination and Gauss-Seidel iterations. [6 P]

4. Assignments on numerical solution of Algebraic Equation by Bisection, Regular-falsi and Newton Raphson methods. [9 P]

5. Assignments on ordinary differential equation: Euler's and Runga-Kutta methods. [9 P]

6. Introduction to Software Packages: Matlab / Scilab / Labview / Mathematica. [6 P]

Subject Name: PROBABILITY AND STATISTICS
Code: BS(CS)306
Contacts: 3L +IT = 4
Credits: 3

Module I - Theory of Probability: [8 L]

One dimensional random variable. Probability distributions-discrete and continuous. Expectation. Binomial, Poisson, Uniform, Exponential, Normal distributions and related problems. t, χ^2 and F-distribution (Definition only). Transformation of random variables. Central Limit Theorem, Law of large numbers (statement only) and their applications. Tchebychev inequalities (statement only) and its application.

Module II – Two Dimensional Distribution: [6 L]

Two dimensional probability distributions. Discrete and continuous distributions in two dimensions. Uniform distribution and two dimensional normal distribution. Joint, marginal and conditional distributions .

Module III - Sampling theory: [6 L]

Random sampling: Parameter, Statistic and its Sampling distribution. Standard error of statistic. Sampling distribution of sample mean and variance in random sampling from a normal distribution (statement only) and related problems. Estimation of parameters: Unbiased and consistent estimators. Point estimation. Interval estimation. Maximum likelihood estimation of parameters (Binomial, Poisson and Normal). Confidence intervals and related problems.

Module IV - Testing of Hypothesis: [8 L]
Simple and Composite hypothesis. Critical region. Level of significance. Type I and Type II errors. One sample and two sample tests for means and proportions. χ^2 - test for goodness of fit.
Neyman-Pearson theorem (Statement only) and its application to normal population. Likelihood ratio testing and its application to normal population. Comparison of Binomial Populations; Normal Populations; Testing of Equality of Means;

Module V - Linear Inference and Multivariate Analysis: [8L]
Multiple Regression analysis, linear regression, curvilinear regression and orthogonal polynomials, discriminant analysis, canonical correlations, principal component analysis.

Books:

1. Banerjee A., De S.K. and Sen S.: Mathematical Probability, U.N. Dhur & Sons.
2. De S.K. and Sen S.: Mathematical Statistics, U.N. Dhur & Sons.
3. Gupta S. C and Kapoor V K: Fundamentals of Mathematical Statistics, Sultan Chand & Sons.
4. Das N.G.: Statistical Methods, TMH.
5. Spiegel M R., Schiller J.J. and Srinivasan R.A. : Probability and Statistics (Schaum's Outline Series), TMH.
6. Multivariate Data Analysis: Joseph F. Hair, Rolph E. Anderson , Prentice Hall Higher Education, 2010.
7. Applied Multivariate Statistical Analysis: R. A. Johnson and D.W. Wichern, PHI.
8. Fundamentals of Statistics (Vol-1) ; A.M. Gun, M.K. Gupta and B. Dasgupta, World Press.
9. Probability and Statistics; D. Biswas, New Central Book Agency.
10. Probability, Statistics and Random Processes; T Veerarajan, Tata McGraw-Hill.

Computer Organization
Code: CS303
Contacts: 3L +1T
Credits: 3

Introduction : [3 L]
History of computing, von Neumann machine, Instruction and data, fixed-point and floating-point numbers, errors, IEEE standards

Processor design: [7 L]
Instruction Set Architecture-Instruction format, opcode optimization; operand addressing; Instruction implementation-data movement, branch control, logical, Input/output and debugging instructions; arithmetic instruction implementation–addition and subtraction, multiplication-division, 2's complement multiplication;
Booth's algorithm–theory and examples; bit-pair algorithm; high performance arithmetic

Control unit design: [8 L]
hardwired control, micro-programmed control design – micro-instruction formats, control optimization;

Memory subsystem: [9 L]
Memory technology, memory interfacing, Memory hierarchy–introduction to virtual memory system; cache memory – performance, address mapping, content addressable memory (CAM)

Peripherals: [7 L]
Basic properties, bus architectures, interfacing of I/O devices, data transfer schemes –programmed I/O, DMA, mass storage, RAID

Pipelining: [6 L]
pipelining datapath and instructions, speed up, CPI, latency; linear / non-linear pipeline–reservation table, MAL; super-pipelined and super-scalar processors.

Text Book:
1. Mano, M.M., "Computer System Architecture", PHI.
2. BehroozParhami " Computer Architecture", Oxford University Press

Reference Book:
1. Hayes J. P., "Computer Architecture & Organisation", McGraw Hill,
2. Hamacher, "Computer Organisation", McGraw Hill,
3. N. senthil Kumar, M. Saravanan, S. Jeevananthan, "Microprocessors and Microcontrollers" OUP
4. Chaudhuri P. Pal, "Computer Organisation & Design", PHI,
5. P N Basu- "Computer Organization & Architecture" , Vikas Pub

Computer Organization Lab
Code: CS393
Contacts: 3P
Credits: 2

1. Design of adders [6 P]
2. Memory module design [9 P]
3. Implementation of simple memory test logic (such as March test) [6 P]
4. Realization of data transfer among CPU registers, Main memory and External sources [9 P]
5. Swapping of registers' contents [6 P]
6. Control design [9 P]

Data Structure & Algorithm
Code: CS304
Contacts: 3L +1T
Credits: 3

(***Note*****:** *examples should be given using pseudo codes; actual codes have to be developed in the practical classes. Preliminary knowledge of coding and executing some simple programs is required*)

The problem solving process: algorithms and data structure; role of data structure in algorithm efficiency; example: design of an array without and with distinct subscript. [1]

Introduction to algorithms: definition, properties, types (only brute force, divide and conquer, greedy, iterative improvement and recursive); pseudo codes. Time and space complexity: asymptotic notations- Big-Oh and big Theta; properties, simple examples. [2]

Recurrence relations: substitution method. Example- development of recurrence relations from simple pseudo codes. [1]

Abstract Data Type (ADT): concepts of data types, ADT and data structure. Typical ADT: integer, array and list; primitive data types. [1]

Linear and non-linear data structures-definition and examples. [1]

Arrays as data structure: memory representation and implicit addressing; 1D and 2D, row major and column major representations, address translation; language dependence. Applications: polynomial and matrix representation. [2]

Linked Lists: explicit addressing in a node (pointer/reference); singly linked list, circular linked list, doubly linked list. Applications: polynomial (up to three variables) and matrix representation- advantages and disadvantages w.r.t array based representation; large integer arithmetic. Multi-list sparse matrices. [3]

Stack: definition, implementation with arrays and linked lists. infix, postfix and prefix notations- conversion and evaluation; palindromes. Use of stack in nested and recursive call of functions, differences between recursion and iteration, tail recursion. Application - The Tower of Brahma problem. [3]

Queue: circular queue, dequeue. Implementation of queue - linear and circular (using array and linked list); Application: well-formed parenthesis checking. [2]

Trees: basic terminologies, recursive nature; types: free tree, ordered and rooted tree, forest. Tree representation with array and linked list. Binary trees: definition; node, path, level, height; skewed and complete binary tree; extended binary tree. Basic properties of binary trees : height of a CBT, maximum and minimum number of nodes, degree of nodes and their relationship, number of distinct binary trees with n nodes (statement only). Binary tree traversal (pre-, in-, post- level-order); threaded binary tree (left, right, full) - non-recursive traversal using threaded binary tree, advantage; expression tree. Application: Huffman’s algorithm. [5]

Binary search tree: definition; operations (creation, insertion, deletion, searching). Height balanced binary tree – AVL tree and rotations for balancing, insertion and deletion of nodes (with examples only). Tries. Concept of balanced tree structures; B-tree. [3]

Graph: graph as: a mathematical structure, an ADT, a data structure. Representations of graphs in an algorithm - adjacency matrix, adjacency list, incidence matrix and incidence list; comparison. Graph traversal– DFS, BFS, and applications. Minimal spanning tree – Prim's and Kruskal's algorithm.[1] [5]

Sorting: inversion and unsortedness, definition. Classification - internal and external sorts; stability of a sorting algorithm. Sorting by comparison: calculation of lower bound; algorithms- Bubble sort, Insertion sort, Selection Sort, Quick sort, Merge Sort. Linear time sorting: Counting sort, Radix sort. Comparisons of different sorting algorithms.[2] [6]

Heap data structure: Binary heap (max and min). Use: priority queue. Heap sort.[1] [2]

Searching: sequential search using arrays and linked list.[2] Binary search (recursive and non-recursive) and comparison tree[3]; Interpolation search. Comparison of the three algorithms[1] [3]

Hashing: concept of key-to-address transformation, direct addressing, advantages and disadvantages: comparison with other search techniques. Hash functions- division remainder, multiplication, extraction, compression; brief comparison. Collision resolution techniques- open addressing (linear and quadratic probing), chaining; load factor and comparison[1]; applications. [3]

Notes:

[1] Statement of time complexities only.

[2] Derivation of worst case and average case time complexities.

[3] Derivation of worst case time complexity, and mention of average case time complexity.

Text books:

1. **D.E. Knuth:** *The Art of Computer Programming* (Vol. 1& 3), Pearson, 1997.
2. **Horowitz, Sahni, Anderson-Freed**: *Fundamentals of Data Structures in C* (Second Edition), Universities Press, 2008.
3. **T.H. Cormen, C.E. Leiserson, R. Rivest and C. Stein**: *Introduction to Algorithms*, (Second/Third Edition), PHI, 2009.
4. **R. Sedgewick**: *Algorithms in C*, Pearson, 2004.

Reference book:

1. **Ronald L. Graham, Donald E. Knuth, and Oren Patashnik:** *Concrete Mathematics: A Foundation for Computer Science.* Addison-Wesley, 1988.

Subject Name: ALGORITHMS-I LAB
Code: CS 394
Contacts: 3P
Credits: 2

1. **Review of Introduction to Computing and Computing Practice**:
Assignments based on Array, etc. [6P]

2. **Assignments based on Stack and its Applications:** Parenthesis matching, Evaluation and Conversion of Expressions in Postfix notation, etc. [6P]

3. **Assignments on search algorithms (sequential, binary and interpolation) on ordered and/or unordered data. [3P]**

4. **Assignments on sorting algorithms (bubble sort, selection sort, merge sort, quick sort, etc.):** Implementation and performance comparisons. [3P]

5. **Assignments on queues (circular queue, priority queue):** Implementation and applications. [3P]

6. **Assignments on linked lists (linear, circular, doubly linked list, etc):** Implementation and applications. [6P]

7. **Assignments on tree (binary tree, binary search tree, arithmetic expression tree, AVL tree):** Implementation, creation, operations, applications, etc. [6P]

8. **Assignments on graph:** Representations, Implementations and Applications. [3P]

COURSE STRUCTURE OF SEMESTER-IV

SL. NO.	PAPER CODE	PAPER NAME	L	T	P	CONTACT HRS./WEEK	CREDIT
THEORY							
01.	BS 407	LIFE SCIENCE	3	0	0	3	3
02.	CS405	GRAPH THEORY & COMBINATORICS	3	1	0	4	3
03.	CS406	COMMUNICATION ENGINEERING	3	0	0	3	3
04.	CS407	MICROPROCESSOR & INTERFACING	3	1	0	4	3
05.	CS408	FORMAL LANGUAGE & AUTOMATA THEORY	3	1	0	4	3
PRACTICAL							
06.	CS495	SOFTWARE TOOLS LAB	0	0	3	3	2
07.	CS496	COMMUNICATION ENGINEERING LAB	0	0	3	3	2
08.	CS497	MICROPROCESSOR LAB	0	0	3	3	2
09.	CS498	ALGORITHMS – II LAB	0	0	3	3	2
		TOTAL	15	3	12	30	23

Life Science (BS407)
Contact-3L, Credit-2

Module 1A: *Concepts in Biology* covering, Chemical foundations and basic chemistry of cell- Carbon compounds and cell as a unit of life; Physical and chemical principles involved in maintenance of life processes; Scientific methods- Microscopy (principles and applications);

Module1B: *Cell structure and functions* covering, Ultra-structure and functions of cellular components- Prokaryotic and Eukaryotic cells, cell wall, plasma membrane, endoplasmic reticulum; Biomolecules- Carbohydrates, Lipids, Amino Acids, Proteins, Nucleic acids; Tissue systems- Overview of animal and plant tissue systems;

Module 2A: *Metabolisms* covering Bio-membranes, diffusion, absorption, osmo-regulation; Photo-synthesis and respiration

Module 2B: *Chromosomes and Cell Divisions* covering, Morphology of chromosomes; Cell theory- Cell cycle and phases; Mitosis and meiosis;

Module 3A: *Genetics* covering, Laws of heredity- Biological indicators, bio-censors; Mutations- Cause, types and effects on species;

Module 3B: *Organic Evolution* covering, Origin of life- Haldane and Oparins concepts; Modern concept of natural selection and speciation- Lamarkism, Darwinism/Neo-Darwinism

Module 4 A *Biomaterials - an Overview*

Background-Biomaterial Classifications, Key Properties, Applications--Orthopaedic Applications, Dental Applications, Cardiovascular Applications, Cosmetic Surgery

Module 4B *Human Phyisology –in brief with special emphasis on* Locomotion and movement, Skeletal system, joints, disorders of muscular and skeletal system Body fluids and circulation- Blood groups, human circulatory system- heart, cardiac cycle, heart failure

Module 4 C *Classification of Face and Teeth*

Types of teeth and face, and Orthodontic disorders –crossbite, openbite, overbite, undrbite, overjet

Recommended Books:-

1. BOOK OF BIOCHEMISTRY AND HUMAN BIOLOGY - BY G. P. TALWAR, L .M. SRIVASTAVA
2. CELL BIOLOGY AND GENETICS BY GEETA BANSAL, M. C. BHATNAGAR
3. TEXTBOOK OF STRUCTURAL BIOLOGY BY: ANDERS LILJAS, LARS LILJAS JURE PISKUR, GÖRAN LINDBLOM, POUL NISSEN AND MORTEN KJELDGAARD
4. LEHNINGER-PRINCIPLES-OF-BIOCHEMISTRY-5TH-EDITION
5. TEXT BOOK OF BIOLOGY, BY S VENUGOPAL

Subject Name: Graph Theory & Combinatorics
Code: CS405 , Contacts: 3L +IT = 4, Credits: 3

Module I: [8L]
Introduction to Propositional Calculus: Propositions, Logical Connectives, Conjunction, Disjunction, Negation and their truth table. Conditional Connectives, Implication, Converse, Contrapositive, Inverse, Biconditional statements with truth table,
Logical Equivalence, Tautology, Normal forms-CNF, DNF; Predicates and Logical Quantifications of propositions and related examples.

Module II: [10L]
Theory of Numbers: Well Ordering Principle, Divisibility theory and properties of divisibility; Fundamental theorem of Arithmetic; Euclidean Algorithm for finding G.C.D and some basic properties ofG.C.D with simple examples; Congruences, Residue classes of integer modulo n (Zn) and its examples.Order, Relation and Lattices: POSET, Hasse Diagram, Minimal, Maximal, Greatest and Least elements in a PO SET, Lattices and its properties, Principle of Duality, Distributive and Complemented Lattices.

Module III: [10L]
Pigeon- hole Principle, Principles of inclusion and exclusions; Recurrence relations: Formulation & Modeling of different counting problems in terms of recurrence relations, Solution of linear recurrence relations with constant coefficients (upto second order) by (i) The iterative method (ii) Characteristic roots method (iii) Generating functions method.
Group, Subgroup, Cyclic group, Permutation group, Symmetric group (S3), Coset, Normal subgroup, Quotient group, Homomorphism & Isomorphism (Elementary properties only). Definition of Ring, Field, Integral Domain and simple related problems.

Module IV :[10 L]
Planar and Dual Graphs. Kuratowski's graphs. Homeomorphic graphs. Eulers formula (n - e + r = 2) for connected planar graph and its generalisation for graphs with connected components. Detection of planarity. Graph colouring. Chromatic numbers of Cn, K, , Km•n and other simple graphs. Simple applications of chromatic numbers. Upper bounds of chromatic numbers (Statements only). Chromatic polynomial. Statement of four and five colour theorems. (10 L)

Module V: [10L]
Graph Coloring: Chromatic Numbers and its bounds, Independence and Clique Numbers, Perfect Graphs-Definition and examples, Chromatic polynomial and its determination, Applications of Graph Coloring. Matchings: Definitions and Examples of Perfect Matching, Maximal and Maximum Matching, Hall's Marriage Theorem (Statement
only) and related problems.

Books:
1. Russell Merris, Combinatorics, Wiley-lnterscience series in Discrete Mathematics and Optimisation
2. N. Chandrasekaran and M. Umaparvathi, Discrete Mathematics, PHI
3. Gary Haggard, John Schlipfand Sue Whitesides, Discrete Mathematics for Computer Science, CENGAGE Learning
4. Gary Chartrand and Ping Zhang - Introduction to Graph Theory, TMH
5. J.K. Sharma, Discrete Mathematics, Macmillan

Communication Engineering
Code: CS406
Contacts: 3L
Credits: 03
Total Lectures: 38

Module one:
Introduction to Communication Engineering [**02**L]
Amplitude Modulation:Concept of AM**,** Calculation of Modulation Index, Total transmitted power of AM, DSB-SC Modulation, SSB- SC Modulation and their methods, Bandwidth calculation, Savings of Power,
Demodulation of AM. [**10L**]

Module two:
Frequency Modulation: Concept of FM, Direct & Indirect Method, Bandwidth calculation of FM, Demodulation of FM. [**05L**]
Phase Modulation: Concept of Phase Modulation, generation of PM from FM. [**02L**]

Module three:
Pulse & Digital Communication: Sampling Theorem, PAM, PWM, PPM. PCM Transmitter & Receiver, DPCM, Companding, TDM & FDM, Delta Modulatrion, Quantization Noise in PCM System, Signal to Quantisation Noise ratio in PCM System. [**09L**]
ASK, FSK, PSK, BPSK, QPSK. [**03L**]

Module four:
Data Formatting: NRZ-Unipolar, NRZ-Polar, NRZ-Bipolar, RZ-Bipolar, Manchester Coding. [**02L**]
Synchronous & Asynchronous Data Transmission. [**03L**]

Concept of Satellite Communication. [**02L**]

Reference Books:

1. Modern Digital and Analog Communication Systems by B. P. Lathi; Published by Oxford University Press.
2. A Text Book of Analog and Digital Communication by P. Chakrabarti; Published by Dhanpat Rai & Co.
3. A Text Book of Communication Engineering by A. Kumar; Published by Umesh Publications.
4. Modern Electronic Communication: Principles and Practice by Sarma and Sinha; Published by Dhanpat Rai Publishing Company
5. Communication Systems by Simon Haykin; Published by Wiley Student Edition
6. Analog & Digital Communications by Simon Haykin and Michael Moher; Published by Wiley Student Edition

Microprocessor & Interfacing
Code: CS- 407
Contacts: 03L + 01T
Credits: 03
Total Lectures: 38

Module one:
Introduction to Microprocessors and their features.
Demultiplexing of Address & Data Bus, Generation of Read Write Control Signal for Memory & I/O. Uses of Decoder & Latch, Changes of Memory Map. [**05L**]

Module two:
8085 Microprocessor: Architecture, Register Organisation, Control Signals, Hardware & Software Interrupts, Instruction Set, Addressing Modes & Assembly Language Programming. [**07**L]

Instruction Cycle, Machine Cycle, T-State, Timing Diagram [**03**L]

Interfacing of Memory Chips with Microprocessor, I/O Mapped I/O & Memory Mapped I/O. [**03L**]

Module three:
Working of DMA Controller, Microprocessor based A/D Conversion using ADC0804. [**03**L]

Peripherals: 8255, 8253, 8259, 8237 [**09**L]

Industrial Applications of Microprocessor. [**01**L]

Module four:
8086 Microprocessor: Architecture, Memory Segmentation, Mimimum Mode & Maximum Mode, Addressing Modes, brief description of Instruction Set and Assembly Language Programming. [**06L**]

Brief overview of some other Microprocessors [**01L**]

Reference Books:

1. Microprocessor Architecture, Programming, and Applications with the 8085 by Ramesh Gaonkar; Published by Penram International Publishing (India) Private Limited.
2. Fundamentala of Microprocessors and Microcomputers by B. Ram; Published by Dhanpat Rai Publications
3. Microprocessors and Microcontrollers by N. Senthil Kumar, M. Saravanan and S. Jeevananthan; Published by Oxford University Press
4. Advanced Microprocessors and Peripherals: Architecture, Programming and Interfacing by A.K. Ray and K M Bhurchandi;Published by Tata McGraw-Hill Publishing Company Limited.
5. The 8051 Microcontroller and Embedded Systems:Using Assembly and C by M. A Mazidi, J .G. Mazidi and R. D. McKinlay; Published by Pearson.
6. The 8051 Microcontroller by Kenneth Ayala; published by Cenage Learning India Privata Limited.

Subject Name: Formal Language and Automata Theory
Code: CS408
Contacts: 3L +IT = 4
Credits: 3

Module-1:

Fundamentals: Basic definition of sequential circuit, block diagram, mathematical representation, concept of transition table and transition diagram (Relating of Automata concept to sequential circuit concept) Design of sequence detector, Introduction to finite state model [2L]
Finite state machine: Definitions, capability & state equivalent, kth- equivalent concept [1L]
Merger graph, Merger table, Compatibility graph [1L]
Finite memory definiteness, testing table & testing graph. [1L]
Deterministic finite automaton and non deterministic finite automaton. [1L] Transition diagrams and Language recognizers. [1L]

Module-2:

Finite Automata (deterministic and non deterministic), equivalence of deterministic and non-deterministic finite Automata. [4L]
Myhill-Nerode Theorem, Minimization of FSM. [2L]
Regular Languages : Regular sets. [1L]
Regular expressions, identity rules. Arden's theorem state and prove [1L]
Constructing finite Automata for a given regular expressions, Regular string accepted by NFA/DFA [1L]
Pumping lemma of regular sets. Closure properties of regular sets (proofs not required). [1L]
Grammar Formalism: Regular grammars-right linear and left linear grammars. [1L]
Equivalence between regular linear grammar and FA. [1L]
Inter conversion, Context free grammar. [1L]
Derivation trees, sentential forms. Right most and leftmost derivation of strings. (Concept only) [1L]

Module:-3 Context free Language

Context free grammars(CFG) and languages (CFL), Derivations, Parse trees, Equivalence of parse tree and derivation. [3L]
Ambiguous, unambiguous and inherently ambiguous grammars. [1L]
Normal forms (Chomsky and Greibach), Simplification of CFG [1L]
Pushdown automata (deterministic and nondeterministic), Acceptance of language by empty stack, final state and their equivalence . [4L]
Properties of the class of CFLs, Proving a language to be context free language or not. Pumping lemma for CFG. [2 L], Decision algorithms of CFG. Membership checking (CYK algorithm)

Module:-4 Recursive and Recursively enumerable Language

Unrestricted grammar, Computable fuction [2 L]
Turing machines (deterministic and nondeterministic). Equivalence of deterministic and non-deterministic TM. Extensions of TM and their simulations. [3 L]
Church-Turing thesis, universal TM, Halting problem of TM, TM as enumerator. [3L].
Decidability, Un-decidablity/Non-computability, Complexity classes, Notion of reductions. [4L]

TEXT BOOKS:

"Introduction to Automata Theory Language and Computation", Hopcroft H.E. and Ullman J. D., Pearson Education.
"Theory of Computer Science ", Automata Languages and computation", Mishra and Chandrashekaran, 2nd edition, PHI.
"Formal Languages and Automata Theory", C.K.Nagpal, Oxford

REFERENCES:

2.1 "Switching & Finite Automata", ZVI Kohavi, 2nd Edn., Tata McGraw Hill
2.2 "Introduction to Computer Theory", Daniel I.A. Cohen, John Wiley
2.3 "Introduction to languages and the Theory of Computation", John C Martin, TMH

2.4 “Elements of Theory of Computation”, Lewis H.P. & Papadimitrou C.H. Pearson, PHI

Subject Name:- Software Tools Lab
Paper Code-CS495,
Credit-2,
Contact Hrs-3P

1. Visual Basic Environment (2P)- How to use VB complier to compile / debug as well as run the programs. Concept about VB-form, Project, Application, Tools, Toolbox, & Properties. Introduction to VB Controls - Labels, Command Buttons, Text Boxes , Frames, Check Boxes , Option Buttons, timer control, images, Designing the User Interface using forms.

2. Data type options & Variables in VB(2P) – Different types of variables- Public, Private, Static, Constants, Data types and their naming rules/conventions, Scope of variables, Val Function, Arithmetic Operations, List boxes & Combo Boxes for Data lists- AddItem Method, List box Properties, Removing an item from a list, data Arrays-concept of single & two dimensional arrays.

3. Decision making using Conditions in VB (2P)– Use of ‘ If then-else’ Statement, Compound Conditions(And, Or, Not), Case Structure ,Using If statements with Option Buttons & Check Boxes, use of different loops- Do/Loops, For/Next Loops, String manipulations– concept of String reserve, comparing, concatenation, length calculation, counting, mid function.

4. Sub-functions & Procedure details(1P)- Concepts of menu - defining and modifying menu, Use of Dialog box, Use of Input box () & Msgbox () functions, Creating a New sub-procedure, passing arguments to procedure by value or by reference, Using Call Statement to call a procedure.

5. Handling of Projects including relevant form design with the help of visual programming aids –

(**i) Setting up Database connectivity with VB(2P)** - Creating the database files using MS-Access, Linking of different tables; establishing the connections between the MS-Access Database and VB (as the front end tool) using ODBC database connectivity. Use of Multiple Forms - Creating, adding, removing forms in project, use of Show Method, Load and Unload options.

(ii) Manipulation of the Database through VB(1P)- Accessing the MS-Access Database from the VB applying different queries, updating the Database i.e. adding, deleting updating the records.

(iii) Project related case studies (2P)

Communication Engineering Lab

Code: CS- 496

Total Lab Periods: 30

Practical Designs & Experiments:

Module - 1: Generation of Amplitude Modulation [**06** Periods]

Module - 2: Generation of FM [**06** Periods]

Module - 3: Generation of PAM [**06** Periods]

Module - 4: Generation of PWM & PPM [**06** Periods]

Module -5: Generation of TDM Pulses [**06** Periods]

Microprocessor & Interfacing Lab
Code: CS- 497

Total Lab Periods: 30

Name of the Experiments:
Module -1
Familiarization with 8085 register level architecture and trainer kit components. [**03** Periods]
Module -2
Study of prewritten programs on trainer kit using the basic instruction set (data transfer, Load/Store, Arithmetic, Logical etc.) [**09** Periods]

Module - 3
Programming using kit/simulator for
i) Table look up
ii) Copying a block of memory
iii) Shifting a block of memory [**04** Periods]
Module - 04
Program using subroutine calls and IN/OUT instructions using 8255 PPI on the Trainer Kit. Subroutine for delay, reading switch state & glowing of LEDs accordingly, finding out the frequency of a pulse train etc. [**06** Periods]
Module - 05
Interfacing with I/O modules:
a) ADC
b) Keyboard
c) Multi-digit Display with multiplexing
d) Stepper motor [**08** periods]

Subject Name:- Algorithms-II Laboratory
Code:- CS498
Contact Hrs.-3P
Credit: 2

Module-I
Implementation of sorting algorithms (comparison based and linear time sorting) and comparing their efficiencies [3P]
Module-II
Determining k-th smallest element of an input array of size n in linear worst case running time [3P]
Module-III
Implementation of hashing [3P]
Module-IV
Solving problems using greedy algorithms [6P]
Module-V
Solving problem using Dynamic programming [3P]
Module-VI
Solving problem using back-tracking [3P]
Module-VII
Implementing graph algorithms (e.g., single source shortest path problem, all-pair shortest path problem)-[6P]
Module-VIII
Implementation of Approximation algorithm for NP-complete problems [3P]