PROPOSED SYLLABUS

for

B.Tech. Programme

in

Computer Science & Engineering

राष्ट्रीय प्रौद्योगिकी संस्थान अगरतला

National Institute of Technology Agartala

Department of Computer Science and Engineering

Agartala, Jirania– 799055

SECOND SEMESTER

Course Code	Course Name	L	T	P	Credits
	Introduction to Programming	3	1	0	4
	Introduction to Programming Laboratory	0	0	3	2
	TOTAL	3	1	3	6

THIRD SEMESTER

Course Code	Course Name	L	T	P	Credits
UCS03B01	Mathematics – III	3	1	0	4
UCS03B02	Engineering Economics & Costing	4	0	0	4
UCS03C01	Digital Circuits & Logic Design	3	1	0	4
UCS03B03	Discrete Mathematical Structures	3	1	0	4
UCS03C02	Data Structures & Programming Methodology	4	0	0	4
UCS03P01	Digital Circuits & Logic Design Laboratory	0	0	3	2
UCS03P02	Data Structures Laboratory	0	0	3	2
	TOTAL	17	3	6	24

Total: Lectures = 17; Tutorials = 3; Practical= 6 Total Credits= 24

FOURTH SEMESTER

Course Code	Course Name	L	T	P	Credits
UCS04B01	Mathematics - IV	3	1	0	4
UCS04C01	Design & Analysis of Algorithm	4	0	0	4
UCS04C02	Computer Organization	3	1	0	4
UCS04C03	Formal Language & Automata Theory	3	1	0	4
UCS04C04	Object Oriented Programming	4	0	0	4
UCS04P01	Algorithm Laboratory	0	0	3	2
UCS04P02	Object Oriented Programming Laboratory	0	0	3	2
	TOTAL	17	3	6	24

Total: Lectures = 17; Tutorials = 3; Practical= 6 Total Credits= 24

FIFTH SEMESTER

Course Code	Course Name	L	T	P	Credits
UCS05C01	Microprocessor & Applications	4	0	0	4
UCS05C02	Operating System	4	0	0	4
UCS05C03	Data Communication	4	0	0	4
UCS05C04	Software Engineering	3	0	0	3
UCS05C05	Graph Theory & Combinatorics	3	1	0	4
UCS05P01	Microprocessor Laboratory	0	0	3	2
UCS05P02	Operating system Laboratory	0	0	3	2
UCS05P03	Software Engineering Laboratory	0	0	3	2
	TOTAL	18	1	9	25

Total: Lectures = 18; Tutorials = 1; Practical= 9 Total Credits= 25

SIXTH SEMESTER

Course Code	Course Name	L	T	P	Credits
UCS06C01	Database Management System	4	0	0	4
UCS06C02	Compiler Design	3	1	0	4
UCS06C03	Computer Networks	3	1	0	4
UCS06C04	Artificial Intelligence	4	0	0	4
UCS06P01	Database Management System Laboratory	0	0	3	2
UCS06P02	Compiler Design Laboratory	0	0	3	2
UCS06P03	Computer Networks Laboratory	0	0	3	2
	TOTAL	14	2	9	22

Total: Lectures = 14; Tutorials = 2; Practical= 9 Total Credits= 22

N.B.: B – Basic Core, C – Departmental Core, P - Practical's
L- Lectures, T- Tutorials, S-Seminar

SEVENTH SEMESTER

Course Code	Course Name	L	T	P	Credits
UCS07B01	Management & Managerial Economics	4	0	0	4
	Elective-I	4	0	0	4
	Elective-II	4	0	0	4
	Elective-III	4	0	0	4
UCS07P01	Project -I	0	2	4	4
	Industrial Training				0
	TOTAL	16	2	4	20

Total: Lectures = 16; Tutorials = 2; Practical= 4 Total Credits= 20

EIGHTH SEMESTER

Course Code	Course Name	L	T	P	Credits
UCS08C01	Distributed Systems	3	0	0	3
	Elective-IV	4	0	0	4
	Elective-V	4	0	0	4
	Elective-VI	4	0	0	4
UCS08P01	Project -II	0	2	6	6
UCS08P02	Grand Viva	0	0	0	4
	TOTAL	15	2	6	25

Total: Lectures = 15; Tutorial=2 ; Practical= 6 Total Credits= 25

Total Credits from 3rd to 8th Semester = 140

N.B.: B – Basic Core, C – Departmental Core, P - Practical's
L- Lectures, T- Tutorials, S-Seminar

List of Electives

Seventh Semester Electives:

Course Code	Course Name	L	T	P	Credits
UCS07E01	Internet Technology	4	0	0	4
UCS07E02	Soft computing	4	0	0	4
UCS07E03	Human Computer Interaction	4	0	0	4
UCS07E04	Digital Signal Processing	4	0	0	4
UCS07E05	Cryptography and Network Security	4	0	0	4
UCS07E06	Modelling and Simulation	4	0	0	4
UCS07E07	Image Processing	4	0	0	4
UCS07E08	Mobile Computing	4	0	0	4
UCS07E09	VLSI System Design	4	0	0	4

Eighth Semester Electives:

Course Code	Course Title	L	T	P	Credits
UCS08E01	Embedded & Real time Systems	4	0	0	4
UCS08E02	Pattern Recognition	4	0	0	4
UCS08E03	Object Oriented Analysis and Design	4	0	0	4
UCS08E04	Advanced Data Base Management System	4	0	0	4
UCS08E05	Parallel Processing	4	0	0	4
UCS08E06	Data Mining and Data Warehousing	4	0	0	4
UCS08E07	Multimedia Technology	4	0	0	4
UCS08E08	E-Commerce	4	0	0	4
UCS08E09	Natural Language Processing	4	0	0	4

N.B.: B – Basic Core, C – Departmental Core, E-Elective, P – Practical.
L- Lectures, T- Tutorials, S-Seminar

DETAILED SYLLABUS

FOR

BACHELOR OF TECHNOLOGY

IN

Department of Computer Science and Engineering

राष्ट्रीय प्रौद्योगिकी संस्थान अगरतला

National Institute of Technology Agartala

Agartala, Jirania– 799055

SECOND SEMESTER

Introduction to Programming	
3 - 1 - 0 : 4 Credits	Prerequisites: *None*

BASICS OF COMPUTERS:
Computer fundamentals: Bits and Bytes, CPU, Memory, Input and output devices, I/O devices, Operating systems, Application softwar's. Number system - Decimal, Binary, Octal, Hexadecimal.

Need for high level languages, Program design using flow charts

C LANGUAGE PRELIMINARIES:
C character set, Identifiers and keywords, Data types, Declarations, Expressions, statements and symbolic constants.
Pre-processor commands: #include, #define, #ifdef
Input-Output: getchar, putchar, scanf, printf, gets, puts.
Operators and expressions: Arithmetic, unary, assignment, logical, conditional, and bit-wise operators.
Control statements: if else, for, while, do-while, switch, break, continue; nested loops
Storage types: Automatic, external, register and static variables.
Functions: Defining and accessing, passing arguments, Function prototypes, Recursion, Library functions, Static functions.
Arrays: Defining and processing, Passing arrays to a function, Multi-dimensional arrays.
Pointers: Basic concepts, malloc, pointers and arrays, simple singly linked list examples

BOOKS RECOMMENDED:

1. Introduction to Computer Science - ITL Education solutions limited , Pearson Education
2. C How to Program - 5th Edition by Deitel published by PHI
3. The C Programming Language by Dennis Ritchie And Brian Kernighan PHI
4. Computer Science: A Structured Programming Approach Using C by Behrouz A. Forouzan, Richard F. Gilberg; Publisher: Course Technology
5. Programming With C - by Gottfried, Byron S; Publisher: TMH
6. C – programming By-E.Balagurusamy; TMH

Introduction to Programming Laboratory	
0 - 0 - 3 : 2 Credits	Prerequisites: *None*

Programming simple problems exercising different features of C

THIRD SEMESTER

MATHEMATICS-III	**UCS03B01**
3 - 1 - 0 : 4 Credits	Prerequisites: *None*

[Detail Syllabus to be submitted by Mathematics Department]

ENGINEERING ECONOMICS AND COSTING	**UCS03B02**
4 - 0 - 0 : 4 Credits	Prerequisites: *None*

[Detail Syllabus to be submitted by Humanities Department]

DIGITAL CIRCUITS & LOGIC DESIGN	UCS03C01
3 - 1 - 0 : 4 Credits	Prerequisites:

NUMBER SYSTEMS AND CODES:
Digital Systems: Number Systems- Binary, Decimal ,Octal and Hexadecimal. Number Base conversion, Complements, Binary Codes, Binary Logic.

BOOLEAN ALGEBRA & LOGIC GATES:
Basic Definitions : Axiomatic definition of Boolean algebra , basic theorems and properties of Boolean algebra, Boolean functions , canonical & standard forms , other logic operations , digital logic gates.

SIMPLIFICATION OF BOOLEAN FUNCTIONS:
The map method, sum of products simplification, product of sums simplification, don't care conditions, NAND and NOR implementations, The tabulation method, Determination of prime implicants, selection of prime-implicants.

COMBINATIONAL LOGIC DESIGN PRINCIPLES:
Switching Algebra. Combinational Circuit Analysis. Combinational Circuit Synthesis. Programmed Minimization Methods. Timing Hazards.

COMBINATIONAL LOGIC DESIGN PRACTICES:
Documentation Standards. Circuit Timing. Combinational PLDs (PLAs; PALs; GALs; Bipolar PLD Circuits; CMOS PLD Circuits; Device Programming and Testing). Decoders. Three-State Buffers. Encoders. Multiplexers. Exclusive OR Gates and Parity Circuits. Comparators. Adders, Subtractors, and ALUs. Combinational Multipliers.

SEQUENTIAL LOGIC DESIGN PRINCIPLES:
Bistable Elements. Latches and Flip-Flops. Clocked Synchronous State-Machine Analysis. Clocked Synchronous State-Machine Design. Designing State Machines Using State Diagrams. State-Machine Synthesis Using Transition Lists. Another State-Machine Design Example. Decomposing State Machines. Feedback Sequential Circuits, VHDL Sequential-Circuit Design Features.

SEQUENTIAL LOGIC DESIGN PRACTICES:
Sequential Circuit Documentation Standards. Latches and Flip-Flops. Sequential PLDs. Counters. Shift Registers. Iterative versus Sequential Circuits. Synchronous Design Methodology. Impediments to Synchronous Design. Synchronizer Failure and Metastability Estimation.

MEMORY, CPLDS, AND FPGAS:
Read-Only Memory. Read/Write Memory. Static RAM. Dynamic RAM. Complex PLDs. FPGAs.

DIGITAL INTEGRATED CIRCUITS:

Introduction to digital logic families, RTL and DTL circuits, integrated injection –logic , transistor logic, emitter coupled, Metal Oxide Semiconductor, complementary MOS.

ANALOG TO DIGITAL & DIGITAL TO ANALOG CONVERTERS:

Study to different types of analog to digital and digital to analog converters, their resolution, conversion time, sensitivity, accuracy and other parameters.

BOOKS RECOMMENDED:

1. Digital Logic & Computer Design - M. Morris Mano, , PHI
2. Digital Electronic Circuits, - T.C. Bartee, Mcgraw Hill Inc.
3. Digital Electronics Principles - D.P. Malvino and Leach, McGraw Hill Inc.
4. Modern Digital Electronics.-R.P. Jain
5. Digital Design Principles and Practices - John F Wakerly, Pearson Education
6. Introduction to Digital Logic Design - J P. Hayes, Addison-Wesley Publishing Co.,

DISCRETE MATHEMATICAL STRUCTURES	**UCS03B03**
3 - 1 - 0 : 4 Credits	Prerequisites: *None*

SET THEORY:

Basic concepts – Notations – Subset – Algebra of sets – The power set – Ordered pairs and Cartesian product – Relations on sets –Types of relations and their properties – Relational matrix and the graph of a relation – Partitions – Equivalence relations – Partial ordering – Poset – Hasse diagram – Lattices and their properties – Sublattices – Boolean algebra – Homomorphism.

FUNCTIONS:

Definitions of functions – Classification of functions - Composition of functions – Inverse functions – Binary and n-ary operations – Characteristic function of a set – Hashing functions – Recursive functions – Permutation functions.

PROPOSITIONAL CALCULUS:

Propositions – Logical connectives – Compound propositions – Conditional and biconditional propositions – Truth tables – Tautologies and contradictions – Contrapositive – Logical equivalences and implications – DeMorgan's Laws - Normal forms – Principal conjunctive and disjunctive normal forms – Rules of inference – Arguments - Validity of arguments.

PREDICATE CALCULUS:

Predicates – Statement function – Variables – Free and bound variables – Quantifiers – Universe of discourse – Logical equivalences and implications for quantified statements – Theory of inference – The rules of universal specification and generalization – Validity of arguments.

GROUPS AND RINGS:

Algebraic systems – Definitions – Examples – Properties – Semigroups – Monoids – Homomorphism – Sub semigroups and Submonoids - Cosets and Lagrange's theorem – Normal subgroups – Normal algebraic system with two binary operations - Codes and group codes – Basic notions of error correction - Error recovery in group codes.

MONOIDS AND GROUPS:

Groups Semigroups and monoids Cyclic semigraphs and submonoids, Subgroups and Cosets. Congruence relations on semigroups. Morphisms. Normal subgroups. Structure of Cyclic groups permutation groups, dihedral groups Elementary applications in coding theory.

Rings and Boolean algebra: Rings Subrings morphism of rings ideals and quotient rings. Euclidean domains Integral domains and fields Boolean Algebra direct product morphisms Boolean sub-algebra Boolean Rings Application of Boolean algebra in logic circuits and switching functions.

BOOKS RECOMMENDED:

1. Trembly J.P and Manohar R,Tata McGraw–Hill Pub. Co. Ltd, New Delhi, 2003.
2. Ralph. P. Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", Fourth Edition, Pearson Education Asia, Delhi, 2002.
3. Bernard Kolman, Robert C. Busby, Sharan Cutler Ross, "Discrete Mathematical Structures", Fourth Indian reprint, Pearson Education Pvt. Ltd., New Delhi, 2003.
4. Kenneth H.Rosen, "Discrete Mathematics and its Applications", Fifth Edition, Tata McGraw – Hill Pub. Co. Ltd., New Delhi, 2003.
5. Richard Johnsonbaugh, "Discrete Mathematics", Fifth Edition, Pearson Education Asia, New Delhi, 2002.
6. Ehrig, H., Mahr, B. Fundamentals of Algebraic Specification I, EATCS
7. Monographs on Theory. Comp. Sc. Vol. 6 Springer, Berlin 1985.
8. Gersting J. Mathematical Structures for Computer science, W. H. Freeman, New York, 1987.
9. Gibbons, A. Algorithmic Graph theory Cambridge Cambridge University Press, 1985.
10. Knuth, D. E. The art of Computer Programming Vol l: Fundamental Algorithms. 2nd ed. Reading, Mass, Addison Wesley 1973.
11. Kolman B. Busby R. discrete Mathematical Structures for Computer Science, Prentice Hall Englewood Cliffs. 1987.
12. Sahni , S. Concepts in discrete Mathematics Fridley MN., Camelot Publ. Comp., 1981.
13. Schmidt G. Strohlein T. Relations Graphs Program, EATS Monograph on Theory Comp. Sc. Vol. 29 Berlin Springer 1993.

14. Weehler W. Universal Algebra for computer Scientist EATCS Monographs on Theory. Comp. Sc. Vol. 25 Springer-Verlag, Barlin 1991.

DATA STRUCTURES & PROGRAMMING METHODOLOGY	**UCS03C02**
4 - 0 - 0 : 4 Credits	Prerequisites: *None*

INTRODUCTION:
Definition, Interrelationship of Data structure and algorithms, Asymptotic complexity analysis, Abstract Data Types, Recursive programming and recurrence relations

ARRAYS:
Representation of arrays, Sparse Representation, Circular arrays

STACKS AND QUEUES:
Fundamental of stacks and queues, Representation with arrays, circular queue, Multiple stacks and queues dynamics, Dequeues.

LINK LISTS:
Singly linked list and their manipulation, doubly linked list, storage pool, Dynamic storage management, Garbage collection, generalized list, Linked stacks and queues.

TREES:
Binary trees and its representation arrays, Tree traversals (preorder, inorder, and postorder), Threaded binary tree, Binary tree representation of tree, heaps, union-find

SORTING AND SEARCHING:
Searching – linear search, binary search, hashing; Binary search trees, Balanced binary search trees, Different algorithms for sorting – bubble sort, selection sort, insertion sort, merge sort, quicksort, heap sort, radix sort, counting sort, lower bounds for sorting,

RECOMMENDED BOOKS:

1. S. Lipschutz, ”Data Structure” , Schaum’s Outline Series, TataMcGraw-Hill
2. Tannenbaum, “Data Structures”, PHI
3. An Introduction To Data Structures With Applications, Tremblay J.P. and Sorenson P.J , Tata Mcgraw Hill
4. ‘Fundamentals of Data Structures’ , Horowitz S. and Sahani S. , Computer Science Press.

DIGITAL CIRCUITS AND LOGIC DESIGN LABORATORY	UCS03P01
0 - 0 - 3: 2 Credits	Prerequisites: *None*

1. To see the working of a BCD-to-7 Segment decoder and to verify the truth table.
2. To study the operation of Arithmetic and logic unit using IC.
3. To construct different types of flip-flops and verify their truth tables. Flip-flops like J-K flip-flops. S-R flip-flop. And D-flip-flop etc.
4. To construct and verify a Master-Slave flip-flop.
5. Construction and study of Modulo-N counter using IC's 7490 decade counter,7493 binary counter.
6. Study of various Interfacing card
   - 12-bit high-speed data acquisition card.
   - PC Bus Extension unit.
   - 16-bit channel Relay output card.
   - Digital IC tester.
   - 7-Segment display card.
   - Amplifier and multiplexer card.
   - Digital I/O and timer counter card.

   This is only the suggested list of experiments. Instructor may frame additional experiments relevant to the course contents

DATA STRUCTURES LABORATORY	UCS03P02
0 - 0 - 3: 2 Credits	Prerequisites: *None*

Implementation of different abstract data structures in C, with implementations using different methods and performance comparisons among them wherever possible. Use of data structures for solving simple problems.

FOURTH SEMESTER

MATHEMATICS –IV	UCS04B01
3 - 1 – 0 : 4 Credits	Prerequisites: *None*

[Detail Syllabus to be submitted by Mathematics Department]

DESIGN AND ANALYSIS OF ALGORITHM	UCS04C01
4 - 0 – 0 : 4 Credits	Prerequisites: *None*

INTRODUCTION:
Definition, Asymptotic notations and complexity analysis (best, worst, and average case), notions of optimality

ALGORITHM DESIGN TECHNIQUES:
Greedy, Divide and Conquer, and Dynamic Programming with examples

MEDIANS AND ORDER STATISTICS:
Minimum and maximum, selection in expected linear time, Selection in worst-case linear time

MISCELLANEOUS ALGORITHMS:
Fractional Knapsack and 0-1 knapsack problems, Integer, matrix and polynomial multiplication, convex hull, closest pairs, string matching, FFT, extended Euclid's algorithm

GRAPHS AND GRAPH ALGORITHMS:
Definition, Representations of graphs, Depth first search, Breadth first search. Kruskal's and Prim's algorithm for minimum spanning tree, Dijkstra's single source shortest path algorithm, Floyd-Warshall all-pairs shortest path algorithm

COMPUTATIONAL COMPLEXITY:

Introduction to NP completeness, The classes P and NP, Polynomial Reduction, NP Hard and NP Complete Problems

Introduction to branch-and-bound, backtracking, and approximation algorithms

BOOKS RECOMMENDED:

1. Introduction to Algorithms by Thomas H.Corman, Charles E. Leiserson and Ronald L. Rivest, PHI.
2. Fundamentals of Algorithms by Bassard Bratley, PHI.
3. The Design and Analysis of Computer Algorithms by Alfred V. Aho, John E. Hopcroft and J.D. Ullman, Addison Wesley Publishing Company.
4. Computer Algorithms by E. Horowitz, S. Sahni & S. Rajsekaran, Golgotia Publications (P) Ltd.

COMPUTER ORGANIZATION	**UCS04C02**
3 - 1 - 0 : 4 Credits	Prerequisites: *None*

COMPUTING & COMPUTERS:
Evolution of computer:-mechanical era, electronic computers, integrated circuits, processor architecture, system architecture.

DESIGN METHODOLOGY:-
System design:-system representation, design process, gate level. Register level:- register level components, programmable logic devices, register level design. The processor level:- processor level components, processor level design.

PROCESSOR BASIC:-
Computer Organization:- Fundamentals, additional features, Data Representation:-basic formats, fixed point numbers, floating numbers. Instruction Sets:-instruction formats, instruction types, programming considerations

CONTROL DESIGN:-
Instruction sequencing & instruction interpretation, Hardwired Control:-design methods, multiplier control unit, CPU control unit, Micro programmed control:- micro instructions & their encoding.

MEMORY:
C.P.U memory interaction, memory array organization & technology, Memory hierarchies, main memory allocation, segment, pages & files .High speed memories, Interleaved memories, caches & associative memories, Cache coherence:-sequential and weak consistency, snoopy bus protocol and directory based.

INPUT-OUTPUT ORGANIZATION:
Addressing I\O devices, Data transfer synchronization, Interrupt handling I/O channels, Computer peripherals & interfacing., Direct Memory Access, Examples of I/O Buses: PCI, SCSI, USB

BASICS OF PIPELINING:
Instruction and data pipelining, speedup, Definitions of pipeline hazards: structural, data, and control and simple techniques for handling them.

BOOKS RECOMMENDED:-

1. H.M. Mann, Computer System Architecture",P.H.I.
2. J.P Hayes, Computer Architecture & Organisation, McGraw-Hill.
3. Computer Organization 5th Ed.-Carl Hamacher Publisher: McGraw-Hill.
4. Computer Organization And Architecture - Stallings Publisher: Pearson Education
5. A.P. Malvino "Digital Computer Electronics", McGraw-Hill.

FORMAL LANGUAGE AND AUTOMATA THEORY	**UCS04C02**
3 - 1 - 0 : 4 Credits	Prerequisites: *None*

INTRODUCTION:
Introduction to language theory, tokens. Alphabets, definition of grammar, Production rules, sentences, sentential forms, language definitions, derivations.

REGULAR LANGUAGES:
Definition, Pumping Lemma of regular sets, Chomsky Hierarchy of languages.

FINITE AUTOMATA:
Finite automaton, Deterministic, Non-Deterministic and their equivalence, Equivalence of regular expressions and FA. Moore and Mealy machines.

CONTEXT FREE LANGUAGE:
Relations between classes of languages, Context Free Grammar, Derivation trees, ambiguity simplification, Normal forms, applications.

PUSHDOWN AUTOMATA:
Pushdown automata, definitions, context free languages, construction of PDA for simple CFLs, Linear bounded automata.

TURING MACHINES:

Turing machines, Introduction to computability, Universal Turing Machines, Types of Turing Machines, Techniques for construction of Turing machines, Undesirability and Halting problem

BOOKS RECOMMENDED:-

1. Introduction To Automata Theory, Languages, And Computation by John E. Hopcroft, Rajeev Motwani , Jeffrey D. Ullman, Publisher: Pearson
2. Z. Kohavi, Switching and Finite Automata Theory, Tata McGraw Hill, 1984.
3. E.V. Krishnamoorthy , Introductory Theory of Computer Science, Affiliated East West

OBJECT ORIENTED PROGRAMMING	**UCS04C04**
4 - 0 - 0 : 4 Credits	Prerequisites: *None*

PRINCIPLES OF OBJECT ORIENTED PROGRAMMING:

A Look at Procedure-Oriented Programming, Object Oriented Programming Paradigm, Basic Concepts of Object Oriented Programming, Benefits of OOP, Object Oriented Languages

TOKENS, EXPRESSIONS AND CONTROL STRUCTURES:

Tokens, Keywords, Identifiers and Constants, Basic Data Types, User-Defined and Derived Data Types, Type Compatibility, Reference, Variables, Scope Resolution Operator, Type Casting, Implicit Conversion, Operator Precedence, Control Structures, Structure, Function.

CLASSES AND OBJECTS:

Class specification, class objects, accessing class members, data hiding, empty classes, pointers within a class, passing objects as arguments, returning objects from functions, friend functions and friend classes, constant parameters and member functions, structures and classes, static members, objects and memory resource, class design steps.

OBJECT INITIALIZATION AND CLEANUP:

Constructors, destructor, constructor overloading, order of construction and destruction, constructors with default arguments, nameless objects, dynamic initialization through constructors, constructors with dynamic operations, constant objects and constructor, static data members with constructors and destructors, nested classes.

OPERATOR OVERLOADING AND TYPE CONVERSION:

Defining Operator Overloading, Overloading Unary Operators, Overloading Binary Operators, Overloading Binary Operators Using Friends, Manipulation of Strings Using Operators, Rules for Overloading Operators, Type Conversions

INHERITANCE: EXTENDING CLASSES:

Deriving Derived Classes, Single, Multilevel, Multiple, Hierarchical, Hybrid Inheritance, constructors & destructors in derived classes, constructors invocation and data members initialization, Virtual Base Classes, Abstract Classes, delegation.

POINTERS, VIRTUAL FUNCTIONS AND POLYMORPHISM:
Pointers to Objects, this Pointer, Pointers to Derived Classes, Virtual Functions, Implementation of run-time polymorphism, Pure Virtual Functions.

WORKING WITH FILES:
Classes for File Stream Operations, Opening and Closing a File, File Pointers and their Manipulations, Sequential Input and Output Operations, Error Handling During File Operations, Command Line Arguments

GENERIC PROGRAMMING WITH TEMPLATES:
Class Templates with multiple parameters, Function Templates, Overloading of Template Functions, Member Function Templates.

OBJECT-ORIENTED ANALYSIS AND DESIGN:
Object-Oriented analysis and design, procedure oriented development tools, prototyping paradigm

BOOKS RECOMMENDED:-

1. Object Oriented Programming By- Budd, Addison Wesley.
2. Mastering C++ By K.R Venugopal , Rajkumar, TMH.
3. C++ Primer, By - Lip man and Lajole, Addison Wesley.
4. The C++ Programming language by Bjarne Stroustrup, Addition-Wesley
5. C++ programming By Robert Leffore
6. Object Oriented Programming with C++ by Balaguruswamy, TMH
7. An Introduction to Object Oriented Programming with C++ by Timthy Budd, Addition-Wesley
8. C++ and Object-Oriented Programming By - Kip R. Irvine, Prentice Hall.

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ALGORITHMS LABORATORY	**UCS04P01**
0 - 0 -3 : 2 Credits	Prerequisites: *None*

Programming different algorithms studied in theory; running on large data sets and observing change in time with input size.

OBJECT ORIENTED PROGRAMMING LABORATORY	UCS04P02
0 - 0 -3 : 2 Credits	Prerequisites: *None*

Programs will be based on theoretical topics covered in the class.

FIFTH SEMESTER

Course Code	Course Name	L	T	P	Credits
UCS05C01	Microprocessor & Applications	4	0	0	4
UCS05C02	Operating System	4	0	0	4
UCS05C03	Data Communication	4	0	0	4
UCS05C04	Software Engineering	3	0	0	3
UCS05C05	Graph Theory	3	1	0	4
UCS05P01	Microprocessor Laboratory	0	0	3	2
UCS05P02	Operating system Laboratory	0	0	3	2
UCS05P03	Software Engineering Laboratory	0	0	3	2
	TOTAL	18	1	9	25

Total: Lectures = 18; Tutorials = 1; Practical= 9 Total Credits= 25

SIXTH SEMESTER

Course Code	Course Name	L	T	P	Credits
UCS06C01	Database Management System	4	0	0	4
UCS06C02	Compiler Design	3	1	0	4
UCS06C03	Computer Networks	3	1	0	4
UCS06C04	Artificial Intelligence	4	0	0	4

UCS06P01	Database Management System Laboratory	0	0	3	2
UCS06P02	Compiler Design Laboratory	0	0	3	2
UCS06P03	Computer Networks Laboratory	0	0	3	2
	TOTAL	14	2	9	22

Total: Lectures = 14; Tutorials = 2; Practical= 9 Total Credits= 22

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L- Lectures, T- Tutorials, S-Seminar

FIFTH SEMESTER

MICROPROCESSOR AND APPLICATIONS	**UCS05C01**
4 - 0 - 0 : 4 Credits	Prerequisites:

INTRODUCTION :
Evolution of microprocessors; iAPX/nn Microcomputer family; Introduction to various types of processors viz Microprocessors, Bit-sliced & Microcontrollers. Intel 8085 Microprocessor Architecture and its operation; Interfacing Devices; Introduction to Interfacing Memory and Input/output devices.

INSTRUCTIONS & TIMINGS:
Instruction Classification and Format, Instruction timings and operation status, Introduction to 8085 instruction set; Data transfer instructions, Arithmetic and logical operations, Branch operations, Advanced Instructions.

PROGRAMMING INTEL 8085 MICROPROCESSOR:
Machine Language Programming, Assembly Language Programming, Debugging a Program, Programming Techniques viz Counting, Looping, Indexing, Stack operations and subroutines.

INTERRUPT MANAGEMENT:
Intel 8085 interrupts, Different types of Interrupts, Interrupt Service Routines, Enabling and disabling Interrupts, Interrupt Vectors, Typical Interrupt Acknowledgment & Response

INPUT/OUTPUT AND INTERFACING:
Basic Interfacing Concepts, Types of I/O, Interfacing Output Displays and Input Keyboards, Memory Mapped I/O and Interfacing Memory.

GENERAL PURPOSE PROGRAMMABLE PERIPHERAL DEVICES:

Basics in Programmable I/Os, Intel 8255 Programmable Peripheral Interface, Intel 8253 Programmable Interval Timer, Intel 8155 and Intel 8755 Multipurpose Programmable Devices; Interfacing, Initialization, Programming typical Applications of all the devices.

SPECIAL PURPOSE PROGRAMMABLE PERIPHERAL DEVICES:
Interfacing Intel 8279 Programmable Keyboard/Display; Intel 8259 Programmable Interrupt Controller, modes; Intel 8257 DMA Controller, modes; Interfacing, Initialization, Programming typical Applications of all the devices.

SERIAL DATA COMMUNICATION:
Serial I/O, Software Controlled Asynchronous Serial I/O, Hardware Controlled Serial I/O; Synchronous Serial Communication; Intel 8250 UART & Intel 8251 USART interfacing, initialization, programming applications.

TYPICAL ADVANCED APPLICATIONS OF MICROPROCESSOR:
Interfacing with ADC & DAC. Designing typical Microprocessor System, Development and Troubleshooting Tools.

BOOKS RECOMMENDED:

1. Ramesh S. Gaonkar, "Microprocessor Architecture, Programming & Applications with 8085", 5/E, Penram International Publishing (India) Pvt. Ltd., Reprint 2006.
2. R. Theagarajan, S. Dhanasekaran, S. Dhanapal, "MicroProcessor & It's Applications", New Age International Publishers, Reprint 2007. "
3. Introduction to Microprocessors: Software, Hardware, Programming, Leventhal; PHI

OPERATING SYSTEM	**UCS05C02**
4 - 0 - 0 : 4 Credits	Prerequisites:

INTRODUCTION:
What is an Operating System, Function of Operating System, Operating System Structure: System Components, Operating System services, System Calls.

PROCESSES:
Process concept, Process State and State Transitions, Process Control Block, Suspend & Resume of Process, Interrupt Processing, Context Switching

PROCESS SYNCHRONIZATION AND INTERPROCESS COMMUNICATION:
The critical-section Problem, Dekker's Algorithm, Semaphores, Synchronization Hardware: Test-and-Set, Compare-and-Swap, Solution of producer-consumer problem.

DEADLOCKS:
System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock

Prevention, Deadlock Avoidance & Banker's Algorithm, Deadlock Detection, Deadlock Recovery.

THREADS:
Single & Multithreading Models, Threading issues, P threads, Solaris 2 Threads, Window 2000 Threads, Linux Threads, Java Threads.

CPU SCHEDULING:
Basic concepts, Scheduling Levels, Scheduling Criteria, Pre-emptive & Non-preemptive Scheduling, Scheduling Algorithms, Multi-processor scheduling,

MEMORY MANAGEMENT:
Memory Organization, Storage Hierarchy, Storage Management Strategies, Swapping, Contiguous & Non Contiguous Memory Allocation, Virtual memory: Paging, Segmentation, Segmentation with Paging, Notion of Locality and working sets, thrashing, page replacement algorithms

FILE-SYSTEM INTERFACE:
File Concepts, File Organization, Access Methods, Directory Structure, File-system Mounting, File Sharing, Protection.

FILE-SYSTEM IMPLEMENTATION:
File-system Structure, File System Implementation, Directory Implementation, Allocation Methods, Free-Space Management, Efficiency and Performance, Recovery.

DISK SCHEDULING:
Disk Structure, Disk Caching, Disk Scheduling, Disk Management, Swap-Space Management, RAID Structure, Disk Attachment, Stable-storage implementation,

PROTECTION:
Goals of Protection, Domain of Protection, Implementation of Access Matrix, Revocation of Access Rights, Capability-Based Systems, Language-based Protection.

SECURITY:
The security Problem, User Authentication, Program Threats, System Threats, Securing Systems and Facilities, Intrusion Detection, Cryptography, Computer-Security Classifications.

BOOKS RECOMMENDED:

1. Operating System Concepts By: Abraham Silberschatz, Peter Baer Galvin & Greg Gagne. John Wiley & Sons, Inc.
2. Operating System By: H M Deitel Pearson Education, LPE.
3. An Introduction to Operating System Concepts & Practice By: Pramod Chandra P Bhatt; PHI Pvt Ltd.

4. Operating Systems : A Design Oriented Approach By – Crowley; TMH
5. Operating Systems : Internals And Design Principles by William Stallings, PHI

DATA COMMUNICATION	**UCS05C03**
3 - 1 - 0 : 4 Credits	Prerequisites: *None*

INTRODUCTION:
Basic goals of communication, Signals for communication: Time-domain and frequency-domain representation of signals. Analog/digital/sampled, periodic/aperiodic, deterministic/random signals.

Fourier series, Fourier transform frequency spectrum, filtering and bandwidth. Message transducers and signal converters. Communication channel: Important characteristics of a communication channel. Available communication channels (media) and their properties. Baseband data communication: Basic concepts of analog and digital communication in the baseband.

Various encoding formats for data. Attenuation and distortion problems and remedies. Maximum data rate of a channel.
Analog Modulation and Demodulation techniques: AM/FM/PM, Principle of demodulating various kinds of modulated signals. Coherent and incoherent receiver

Digital modulation- ASK/FSK/PSK, Binary and M-array data modulation, continuous phase modulation- binary and M-array CPFSK, MSK, partial response CPM. Pulse modulation and pulse coded modulation schemes- PAM/PWM/PPM, PCM/DPCM/ADPCM/DM etc.

Reliable and efficient asynchronous and synchronous data communication: block error handling and channel coding. Bit and character oriented framing. Transparent data communication. Error detection and correction in a frame LRC/VRC/Checksum/ CRC and Hamming code.

PROTOCOLS FOR DATA COMMUNICATION:
Stop and Wait protocol and its efficiency, sliding window protocols- go-back-n and selective repeat. Modem technologies: QAM/MSK/CPFSK/ADSL/Cable Modem

WIRELESS COMMUNICATION:
Data communication over radio/microwave/satellite/infrared links. Principles of Spread spectrum communication- DSSS, FHSS.

OPTICAL COMMUNICATION TECHNOLOGY:
Basic principles and components for point-to-point communication. Multimedia communication and data compression.

BOOKS RECOMMENDED:

1. S. Haykin, "Communication Systems", 3rd edition, John Wiley, 1994
2. H. Taub and D. Schilling, "Principles of Communication Systems", 3rd edition, Tata McGraw Hill
3. W. Stallings, "Data and Computer Communications", 6th edition, Pearson education Asia (IPE), 2000
4. F. Halshall, "Data Communications, Computer networks and Open Systems", 4th edition, Pearson Education Asia (IPE), 1996
5. B.A. Forouzan, "Data Communications and Networking", 3rd edition, Tata McGraw Hill, 2003
6. D. Bertrekas and R. Gallagar, Data Networks, 2nd edition, Prentice Hall (EEE), 1992
7. J.Proakis and M.Salehi, "Communication System Engineering", Prentice Hall, 1995 Schiller, "Mobile Communications", Pearson Education Asia, 2000

SOFTWARE ENGINEERING	**UCS05C04**
3 - 1 - 0 : 4 Credits	Prerequisites: *None*

SOFTWARE AND SOFTWARE ENGINEERING:

The importance of software engineering, Software Components, Software Applications, Software Crisis, Software Myths.

Computer Based System Engineering (CBSE), System Engineering Elements, Abstract functional requirements for CBSE.

SOFTWARE ENGINEERING PARADIGM:

Definition, Lifecycle Concept, Software Development Process Models, Fourth Generation Techniques.

SOFTWARE DEVELOPMENT:

Identification of Need, Feasibility study, SA/SD approach, Data Flow and Logical Data modeling, User Interface Design.

OBJECT ORIENTED ANALYSIS & DESIGN:

Conventional vs. OO approaches, A unified approach to OOA. Domain analysis, OOA process. Design Issues, System Design Process, Object Design Process.

SOFTWARE PROJECT MANAGEMENT:
Principles of Software Project Management, Team Structure & Scheduling, Project Planning, Project Initiation and Project Termination, Total Quality Management (TQM), Different Cost Estimation Methods, COCOMO Model, WBS, Configuration Management, Risk Management, Different Project Management Tools.

SOFTWARE TESTING STRATEGIES:
Different Testing Verification & Validation, System Testing, The Art of Debugging, Proof of Correctness, Black Box Testing & White-Box testing, Control Flow Graphs – Cyclomatic Complexity.

SOFTWARE QUALITY MANAGEMENT:
Software Quality Factors, Quality Assurance, Quality Standards, Software Maintenance.

BOOKS RECOMMENDED:

1. Software Engineering: a Practitioner's Approach (3rd Edition) by Roger S Pressman, Tata McGraw Hill 1992.
2. Software Engineering-Principles and Practice by Jawadekar ,TataMcGraw Hill.
3. Fundamentals of Software Engineering, Ghezzi, P.H.I.
4. Fundamentals of Software Engineering, Rajib Mall, P.H.I.
5. Software Fundamentals, Daniel M. Hoffman & David M. Weiss, Addison Wesley.
6. A Discipline for Software Engineering, Watts S. Humphrey, Addison Wesley.
7. Software Engineering: Theory & Practice, Pfleeger, Addison Wesley.

GRAPH THEORY AND COMBINATORICS	**UCS05C05**
3 - 1 – 0 : 4 Credits	Prerequisites: *None*

INTRODUCTION:
Graphs and their applications, Graph theory terms and concepts: Incidence, degree, vertex, directed and undirected graphs, null graph, sub graphs, union of graphs, isomorphism, walks, connected graphs, paths, circuits, disconnected graphs, Bipartite graphs, Euler's graphs, Hamiltonian graphs.

TRESS AND FUNDAMENTAL CIRCUITS:
Properties of trees, rooted trees, binary trees, spanning trees, fundamental circuits, enumeration of trees: Cayley's theorem

CONNECTIVITY:
Vertex and Edge connectivity, Menger's theorem

MATCHING AND COVERING:
Maximum matching in bipartite and general graphs, stable matching, vertex and edge coverings

INDEPENDENT SETS AND COLORING:
Definitions, vertex and edge coloring, Vizing's theorem, Chromatic polynomial and chromatic recurrence

PLANER GRAPHS:
Planer graphs and their representation. Dual graphs, Detection of planarity, Five-color and Four-color theorem, Thickness and crossing.

INTRODUCTION TO COUNTING:
Basic counting techniques, principles of inclusion and exclusion, pigeon-hole principle, permutation, combination, summations. Introduction to recurrence relation and generating functions.

BOOKS RECOMMENDED:

1) Graphs, Networks and Algorithm: John Wiley and Sons.
2) F. Harary, "Graph Theory", Addison-Wesley,
3) Graph Theory with application to Computer Engineering and Computer Science; By-Deo.
4) Algorithmic Graph Theory by Alan Gibbons.
5) Introduction to Graph Theory: Douglas West
6) V. K. Balakrishnan, Combinatorics, Schaum Series
7) Richard Brualdi, Introductory Combinatorics, Elsevier

OPERATING SYSTEM LAB	**UCS05P01**
0L – 0T – 3P : 3 Credits	Prerequisites: *None*

Programs on the use of pthread library, process creation, shared memory, message queues, semaphores in Linux using simple examples, Development of user-level modules for memory management, file caching etc.

MICROPROCESSOR LAB	**UCS05P02**
0L – 0T – 3P : 3 Credits	Prerequisites: *None*

Microprocessor architecture, Microprocessor programming, Assembly Language of 8085 and 8086 microprocessors, Software controlled serial and parallel I/O in 8085, Use of

programmable interrupt controller, programmable peripheral interface (8255), DMA controller, PIT (8253) and DMA.

Software Engineering Lab	**UCS05P03**
0L – 0T – 2P : 2 Credits	Prerequisites: *None*

Sessional works based on theoretical subject.

SIXTH SEMESTER

DATABASE MANAGEMENT SYSTEM	**UCS06C01**
4 - 0 - 0 : 4 Credits	Prerequisites: *None*

AN OVERVIEW OF DATABASE:
Database, Database System, DBMS Components, Data Independence, Data Abstraction, DDL, DML, Data Dictionary, Data Integration, Database Access Method, Advantages of Using a DBMS.

DATABASE SYSTEM ARCHITECTURE:

Data Models, Schemas, and Instances, DBMS Architecture, Data Independence, Database Languages and Interfaces, Database System Environment, Classification of Database Management Systems.

DATA MODEL USING E-R MODEL & OBJECT MODEL:
High-Level Conceptual Data Models, Entity Types, Entity Sets, Attributes and Keys, Relationships, Relationship Types, Roles, and Structural Constraints, Weak Entity Types, Refining the E-R Design, ER Diagrams, Naming Conventions and Design Issues, Subclasses, Super Classes, Inheritance.

FILE ORGANIZATION:
Secondary Storage Devices, Parallelizing Disk Access Using RAID Technology, Buffering of Blocks, Placing File Records on Disk, Operations on files, Files of Unordered Records (Heap Files), Files of ordered Records (Sorted Files), Hashing Techniques, Other Primary File Organizations. Types of Single-Level Ordered Index, Multilevel Indexes, Dynamic Multilevel Indexes Using B-Trees and B+ Trees, Indexes on Multiple Keys, Other Types of Indexes.

RELATIONAL MODEL:
Relational Model Concepts, Relational Constraints and Relational Database Schemas, Update Operations and dealing with constraint violations, Basic Relational Algebra Operations, Additional Relational Operations, Relational Calculus, Tuple Calculus, Domain Calculus.

RELATIONAL DATABASE STANDARD:
Data Definition, Constraints, Schema Changes in SQL, Basic Queries in SQL, Insert, Delete, and Update statements in SQL, Views (Virtual Tables) in SQL, Specifying General Constraints As Assertion, Additional Features of SQL.

NORMALIZATION FOR RELATIONAL DATABASE:
Functional Dependencies, Normal Forms based on Primary Keys: 1NF, 2NF, 3NF, Boyce-Codd Normal Form, Normalization through Synthesis, Normalization using Join Dependency.

DATABASE DESIGN & TUNING:
Database Design Process, Physical Database Design in Relational Databases, Database Tuning in Relational Systems.

DATABASE RECOVERY & SECURITY:
Transactions, Recovery Concepts, Transaction Recovery, System Recovery, Media Recovery, Recovery Technique, Recovery in Multi Database Systems, Database Security Issues, Access Control for Multilevel Security, Data Encryption.

BOOKS RECOMMENDED:

1. Fundamentals of Database Systems; by: Ramez Elmasri & Shamkant B. Navathe

Pearson Education, LPE.
2. An Introduction to Database Systems; by: C J Date, Pearson Education, LPE.
3. Database System Concepts by Henry F. Korth; McGraw-Hill Publication.

COMPILER DESIGN	**UCS06C02**
3 - 1 - 0 : 4 Credits	Prerequisites: *None*

INTRODUCTORY CONCEPTS:
Analysis-synthesis model of compilation, various phases of a Compiler, Cross compilers: Bootstrapping.

LEXICAL ANALYSIS:
Interface with input, parser and symbol table, token, lexeme and patterns, difficulties in lexical analysis, error reporting, and implementation. Regular definition, Transition diagrams, LEX.

SYNTAX ANALYSIS:
Context free grammars, ambiguity, associativity, precedence, top down parsing, recursive descent parsing, transformation on the grammars, predictive parsing, Bottom up parsing, operator precedence grammars, LR parsers (SLR,LALR, LR), YACC.

SYNTAX DIRECTED TRANSLATION:
Inherited and synthesized attributes, dependency graph, evaluation order, bottom up and top down evaluation of attributes, L- and S-attributed definitions.

TYPE CHECKING:
Type system, type expressions, structural and name equivalence of types, type conversion, overloaded functions and operators, polymorphic functions.

RUN TIME SYSTEM:
Storage organization, activation tree, activation record, parameter passing, symbol table, dynamic storage allocation.

INTERMEDIATE CODE GENERATION :
Intermediate representations, translation of declarations, assignments, and Intermediate Code generation for control flow, Boolean expressions, and procedure calls, implementation issues.

CODE GENERATION AND INSTRUCTION SELECTION:
Issues, basic blocks and flow graphs, register allocation, code generation, DAG representation of programs, code generation from dags, peep hole optimization, code generator generators, specifications of machine.

CODE OPTIMIZATION :

Source of optimizations, optimization of basic blocks, loops, global dataflow analysis, solution to iterative dataflow equations, Code improving transformations, dealing with aliases, data flow analysis of structured flow graphs.

BOOKS RECOMMENDED:

1. Compilers: Principles, Techniques, and Tools by Aho Ullman , Shetty, Pearson Education.
2. Compiler Construction: Principles and Practice by Kenneth C. Louden, Thomson Books.
3. Compiler Design in C by Allen I. Holub, Prentice Hall of India.

COMPUTER NETWORKS	**UCS06C03**
3 - 1 - 0 : 4 Credits	Prerequisites: *None*

INTRODUCTION:
Definition, goals, applications and classification of computer networks. Some well-known networks, Protocols and standards.

NETWORK MODELS:
Layered Tasks, Internet Models, Direct and indirect interconnection, need for addressing and routing. Concept of subnet-structure and topology of subnet, circuit, message and packet switching.

NETWORK ARCHITECTURE:
Layered architecture and protocol hierarchy. OSI Reference Model. Services and important functions of each layer. TCP/IP Model, Design issues of layers.

BRIEF REVIEW OF PHYSICAL AND DATA LINK LAYERS :
Guided and Unguided media, Line Discipline, Flow control, Capacity utilization, Sliding Window, Stop & wait protocols, Error detection mechanism, VRC,LRC,CRC, Automatic Repeat Request(ARQ)- stop-and wait , go-back-n, selective repeat.

MEDIUM ACCESS CONTROL:
ALOHA, Slotted ALOHA, CSMA, CSMA/CD, Ethernet, Token Ring, CSMA/CA

NETWORK LAYER:
Need for Network layer, Connection–oriented and connectionless services, Addressing: Internet address, classful address, subneting, superneting, Classless Addressing, Routing techniques –Static versus Dynamic Routing, flooding, Distance vector and link-state routing, Basics of IP

TRANSPORT LAYER:
Congestion control algorithms. Basics of TCP and UDP.

APPLICATION LAYER PROTOCOLS:

Basics of Telnet, FTP, SMTP, HTTP.

WIRELESS AND MOBILE NETWORKING:
IEEE 802.11, IEEE 802.16, BLUETOOTH and IEE 802.15. Ad-hoc networks. Cellular networks – GSM, CDMA

ISDN, B-ISDN, FRAME RELAY AND ATM NETWORKS:
Concept of ISDN and B-ISDN. Review of the digitization status of the telephone network. X.25, Frame Relay and ATM-evolution, ATM layers, sub layers and their functions, ATM switch architecture.

BOOKS RECOMMENDED:

1. Data Communication and Networking, 4th Edition, McGraw-Hill, Behrouz Forouzan.
2. A. S. Tanenbaum, "Computer Networks", 4th Ed., Pearson Education Asia (LPE), 2003.
3. L.L. Peterson and B.S. Davie, "Computer Networks: A Systems Approach", 2nd Ed., Morgan Kaufman, Harcourt Asia, 2000.
4. W. Stallings, "Data and Computer Communications", 6th Ed., Pearson Education Asia (LPE), 2000.
5. F. Halsall, "Data Communications, Computer Networks and Open Systems", 4th Ed., Pearson Education Asia (LPE), 1996.
6. L. Garcia and I. Widjaja, "Communication Networks: Fundamental Concepts and Key architectures", Tata-McGraw-Hill Ed., 2000.
7. J.F. Kurose and K.W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", Pearson Education Asia (LPE), 2001.
8. L. Kleinrock, "Queuing Systems, Vol. 1: Theory", John Wiley, 1975.
9. Bertsekas and R. Gallagar, "Data Networks", 2nd Ed., PHI (EEE), 1988.
10. W. Stallings, "ISDN and Broadband ISDN with Frame Relay and ATM", 4th Ed.

ARTIFICIAL INTELLIGENCE	**UCS06C04**
4 - 0 - 0 : 4 Credits	Prerequisites: *None*

INTRODUCTION:
What is AI? The foundations of AI. Importance of AI and related fields.

LOGIC:
Propositional and predicate logic, representation atoms, connectives, literals, CNF, DNF and casual form, interpretation and model, satisfiability, resolution principle and unification.

RULES:
Working memory, rule base, conflict set, conflict resolution strategies, backward and forward chaining, meta rules.

REASONING UNDER UNCERTAINTY:
Basic probability notation, probabilistic reasoning, Bayesian networks, certainty factor methods, Dempster-Shafer theory, basics of fuzzy logic.

STRUCTURE REPRESENTATION:
Semantic networks, frames, conceptual dependency, scripts, inheritance, default values**.**

GENERAL ISSUES IN KNOWLEDGE REPRESENTATION AND INTERFERENCE:
Logical agents, reasoning and resolution, adequacy, richness, granularity, ease of representation and use, modeling uncertainty, the fame problem, declarative and procedural representation.

PROBLEM SOLVING BY SEARCHING:
State space repetition, heuristics, heuristic evolution function, and problem reduction. Searching for solutions. Informed and uninformed search strategies.

SEARCH METHODS:
Generate and test, hill climbing, means-ends analysis, depth-first, breath-first, best first, exploiting domain constraints, dependency-directed back tracking, minimax, alpha- beta pruning, iterative deepening.

PLANNING:
Planning by forward and backward reasoning, Nonlinear planning, scheduling

BOOKS RECOMMENDED:

1. Artificial Intelligence by E Rich and K Knight, McGraw-Hill.
2. Artificial Intelligence ($3^{rd\ Ed}$) PH Winston, Addison-Wesley.
3. Introduction of Artificial Intelligence and expert systems by DW Patterson, PHI.
4. Artificial Intelligence a Modern Approach-Stuart Russell, Peter Norvig, PHI
5. Artificial Intelligence and Soft Computing by A. Konar, CRC Press 2000

DBMS Lab	**UCS06P01**
0L – 0T – 3P : Credits	Prerequisites: *None*

SQL query programming, designing databases and accessing them for reasonably large applications.

Compiler Design Lab	**UCS06P02**
0L – 0T – 3P : Credits	Prerequisites: *None*

Design of simple compiler for a subset of PASCAL/C including code generation using lex/yacc.

Computer Network Lab	**UCS06P03**
0L – 0T – 3P : Credits	Prerequisites: *None*

Client-server programming using TCP and UDP sockets, implementation of ARQ techniques, implementation of subset of TCP stack at user level, implementation of simplified versions of application layer protocols such as SMTP/HTTP/FTP etc.

SEVENTH SEMESTER

Course Code	Course Name	L	T	P	Credits
UCS07B01	Management & Managerial Economics	4	0	0	4
	Elective-I	4	0	0	4
	Elective-II	4	0	0	4
	Elective-III	4	0	0	4
UCS07P01	Project -I	0	2	4	4

	Industrial Training				0
	TOTAL	16	2	4	20

Total: Lectures = 16; Tutorials = 2; Practical= 4 Total Credits= 20

Seventh Semester Electives:

Course Code	Course Name	L	T	P	Credits
UCS07E01	Internet Technology	4	0	0	4
UCS07E02	Soft computing	4	0	0	4
UCS07E03	Human Computer Interaction	4	0	0	4
UCS07E04	Digital Signal Processing	4	0	0	4
UCS07E05	Cryptography and Network Security	4	0	0	4
UCS07E06	Modeling and Simulation	4	0	0	4
UCS07E07	Image Processing	4	0	0	4
UCS07E08	Mobile computing	4	0	0	4
UCS07E09	VLSI System Design	4	0	0	4

SEVENTH SEMESTER

MANAGEMENT & MANAGERIAL ECONOMICS	UCS07B01
4 – 0 – 0 : Credits	Prerequisites: *None*

[To be submitted by Humanities Department]

DETAILED SYLLABUS OF
SEVENTH SEMESTER ELECTIVE SUBJECTS

INTERNET TECHNOLOGY	**UCS07E01**
4 – 0 – 0 : Credits	Prerequisites: *None*

THE INTERNET:
Brief history. Organization and architecture.

ROUTING IN THE INTERNET:
Different IP addressing schemes, Subneting, Superneting, RIP, OSPF and BGP.

INTERNET APPLICATION LAYER:
DNS, e-mail, SMTP, POP 3, MIME, HTTP.

QOS IN INTERNET:
RSVP

SECURITY ISSUES:
Basics of cryptography, Attacks in the Internet, IP Spoofing, IP Sniffing, DNS Spoofing; IPSec and SSL, Firewall, VPN

WEB DESIGN BASICS:
HTML, Scripting in Perl/python, CGI scripts, Web-enabled databases, Web services.

BOOKS RECOMMENDED:-

1. Data Communication and Networks, By - Forouzan, TMH
2. Cryptography and Network Security, William Stallings, Low Price Edition
3. Cryptography and Network Security, Atul Kahate, PHI.
4. RFCs for different protocols

SOFT COMPUTING	**UCS07E02**
4 – 0 – 0 : Credits	Prerequisites: *None*

Introduction to Fuzzy sets, Fuzzy t- and s- norms, projection, cylindrical extension, Fuzzy relations, Implication relations, Fuzzy relational equations, Possibilistic reasoning, Fuzzy pattern recognition, Introduction to Fuzzy control and Fuzzy databases.

Biological vs. artificial neurons, McCulloch and Pitts Model, Perceptron as linear classifier, Supervised learning: Perceptron learning algorithm, Steepest descent learning and back-propagation algorithm, Radial basis function neural net. Unsupervised learning: Hopfield neural net, Self-organizing feature map neural net, Competitive neural learning, Reinforcement learning: Q-learning and temporal difference Q-learning, Support vector machine (SVM), Kernelized SVM, Learning vector quantization.

Genetic Algorithm: Binary and real codes, Genetic programming, Particle swarm optimization, Differential Evolution, Bacterial Foraging

Hybridization of neuro-fuzzy, neuro-GA, neuro-swarm, neuro-evolution algorithms. Applications in Pattern Recognition, Robotics, and Image Processing.

BOOKS RECOMMENDED:-

1. Computational Intelligence: Principles, Techniques, and Applications by A. Konar, Springer 2005
2. Computational Intelligence by A. P. Engelbrecht

HUMAN COMPUTER INTERACTION	**UCS07E03**
4 – 0 – 0 : Credits	Prerequisites: *None*

Introduction to HCI methods. Interaction styles and general design. Various user interfaces and interaction strategies. Programming usable interfaces, Software architectures for user interface. Cognitive models, Communication and collaboration models, Collaborative systems. Screen design. Task analysis. Usability evaluation, Groupware and Coordination technologies, HCI and World Wide Web.

Textbook:

1. Human Computer Interaction by Alan Dix, Janet Finley, Gregory Abowd, Russell Beale, Pearson India

DIGITAL SIGNAL PROCESSING	**UCS07E04**
4 – 0 – 0 : Credits	Prerequisites: *None*

General Introduction, Scope and area of applications of Digital Signal Processing

Discrete time systems, linear time invariant (LTI) systems and important properties. Fourier Transform and Laplace transform. Z-transform. Signal flow graphs and digital system representation, Spectral characteristics, inverse z transforms.

Discrete Fourier transforms (DFT) and its properties, Fast Unitary transforms. Introduction to transformation matrices in a general form. Computer exercises.

Digital filters, FIR and IIR, FIR filters - structure, designs. IIR filters - analog filter design, discretization of analog filter, Computer exercises.
Multi rate signal processing Interpolation and decimation, FIR filter banks.

Introduction to least square optimization, signal modeling (AR, MA, ARMA). Normal equation and solution strategy. Applications. Computer exercises.

DSP Application - Introduction to digital signal processors chips, discussion of either TMS320CXX based or ADSPXXX based system, case study of different DSP applications. Application of filters to analog & digital signal processor, FET spectrum analyzer.

Digital processing of continuous time signals- sampling, anti-aliasing filter, sample and hold process, reconstruction filter, Computer exercises.

BOOKS RECOMMENDED:-

1. Alan V . Oppenheim, Ronald W. Schafer, .Discrete-Time Signal Processing., Prentice-Hall of India Pvt. Ltd., New Delhi, 1997
2. Sanjit K Mitra, .Digital Signal Processing: A computer-based approach. TMH.1998
3. John G. Proakis, and Dimitris G. Manolakis, .Digital Signal Processing.(third edition), Prentice-Hall of India Pvt. Ltd, New Delhi, 1997
4. Emmanuel C. Ifeachor, Barrie W. Jervis , .Digital Signal Processing-A practical Approach., Addison . Wesley,1993
5. Abraham Peled and Bede Liu, .Digital Signal Processing., John Wiley and Sons, 1976
6. Haykin and Van Veen, Signals and Systems, (second edition), John Wiley and sons, Inc.,2003.
7. Oppenheim and Schaffer, 'Discrete time Signal processing', PHI, 1992.
8. Ludemann L. C., "Fundamentals of Digital Signal Processing", Harper and Row publications, 1992.
9. Rabiner & Gold, "Theory and applications of Digital signal processing", PHI, 1992.
10. Hamid A. Toliyat and Steven G. Campbell "DSP Based Electro Mechanical Motion Control" CRC Press New York, 2004.

CRYPTOGRAPHY AND NETWORK SECURITY	**UCS07E05**
4 – 0 – 0 : Credits	Prerequisites: *None*

BASIC CRYPTOGRAPHY:

Classification of attacks, Evolution of Cipher Techniques, Symmetric and asymmetric key cryptography, Confusion and Diffusion.

CONVENTIONAL CRYPTOGRAPHY:

Substitution and Transposition ciphers. Cipher Implementation-P-Box, and Product Cipher, Feistel structure, Block Ciphers-DES, AES, Meet in the Middle Attack, Triple DES and IDEA, Classical Techniques, Modern Techniques, Algorithms, Confidentiality Using Conventional Encryption.

PUBLIC-KEY ENCRYPTION AND HASH FUNCTIONS:

Public-Key Cryptography , Deiffie -Hellman Cryptosystem , Man in the Middle Attack ,Message Authentication and Hash functions; Hash and MAC Algorithms,SHA-1 Algorithm, RSA and the Knapsack algorithm.

AUTHENTICATION PROTOCOLS:
Authentication techniques based on Shared Secret Key, Key Distribution Centre, Kerberos, Public Key Encryption and Public Key certificates

DIGITAL SIGNATURES:
Secret Key Signatures. Public Key Signatures and DSS.

NETWORK SECURITY PRACTICE:
Authentication applications, Kerberos, X.509 Directory Authentication Service, Electronic Mail Security; SSL, S/MIME,IP Security Architecture, Combining Security Associations, Key Management, Web Security; Web Security Requirements, Secure Sockets Layer and Transport Layer Security, Secure Electronic Transaction(SET), System Security: Intruders, Viruses and Related Threats, Types of Viruses, Trusted Systems.

E-MAIL AND INTERNET SECURITY:
PGP and PEM, Firewalls, Types of Firewalls, Firewall Configuration, Firewall Design Principles, Classical attacks on the Internet, IP Sec, IP Spoofing attacks.

BOOKS RECOMMENDED:-

1. A. Tanenbaum: Computer Networks, 3rd ed. Prentice Hall, 1996 (PHI 1997).
2. B. Schneider: Applied Cryptography, 2nd ed. Wiley, 1996.
3. C. Kaufman, R. Pearlman and M. Speciner: Network Security, Prentice Hall, 1995.
4. D. R. Stinson: Cryptography: Theory and Practice, CRC Press, 1995.
5. G. J. Simmons Ed.: Contemporary Cryptography, IEEE Press, 1991.
6. Behrouz A. Forouzen, Data Communication and Networking, TMH Press.
7. William Stallings, Cryptography and Network Security, LPE Press.

MODELING AND SIMULATION	**UCS07E06**
4 – 0 – 0 : Credits	Prerequisites: *None*

Simulation and Modeling Objectives, Examples of application in various fields, General Concepts, Continuous and Discrete Models, Monte Carlo Simulation, Review of Basic Probability and Statistics, Stochastic Processes, Discrete Time Markov Chains, Petri Nets: Properties, Analysis and Applications, Variants of Petri Nets: Colored Petri Nets (CPN), Stochastic Petri Nets (SPN), Generalized Stochastic Petri Nets (GSPN), Random Number Generators, Pseudo Random Number Generators, Testing Random Number Generators, Queuing Theory, Distributed Simulation.

BOOKS RECOMMENDED:-

1. Simulation Modeling & Analysis, by A. Law and D. Kelton, McGraw Hill Publishing Co., 2002.
2. Probability and Statistics with Reliability, Queuing, and Computer Science Applications, by Kishor S. Trivedi, John Wiley and Sons, New York, 2001
3. Creating Computer Simulation Systems: An Introduction to the High Level Architecture, Kuhl, Weatherly and Dahmann, Prentice Hall, 2000.
4. Simulation Model Design and Execution: Building Digital Worlds, by P. Fishwick, Prentice-Hall, 1995.
5. Discrete-Event System Simulation, by J. Banks, J. Carson, B. Nelson, D.Nicol, 3rd edition, Prentice Hall, 2001.
6. Parallel and Distributed Simulation Systems, by R.M. Fujimoto, John Wiley, 2000
7. Modelling with Generalized Stochastic Petri Nets, by M. Ajmone Marsan et al, Wiley, 1995
8. The Art of Computer Systems Performance Analysis, by R. Jain, Wiley, 1991.
9. Probabilistic Modelling, by I. Mitrani, Cambridge University Press, 1998
10. Computer and Communication Systems Performance Modeling, by P.J.B. King, Prentice Hall, 1991
11. Performance Modelling with Deterministic and Stochastic Petri Nets, by C. Lindemann,Wiley 1998
12. Theory of Modeling and Simulation, by Bernard P. Zeigler, Tag Gon Kim, Herbert Praehofer, Academic Press, 2000

IMAGE PROCESSING	**UCS07E07**
4 – 0 – 0 : Credits	Prerequisites: *None*

INTRODUCTION:
Image definition and its representation, neighborhood. Orthogonal transformations like DFT, DCT, Wavelet.

ENHANCEMENT AND RESTORATION:
Contrast enhancement, smoothing and sharpening, filtering and restoration

SEGMENTATION:
Pixel classification, global/local gray level thresholding, region growing, split/merge techniques, edge detection operators, Hough transform.
Image feature/primitive extraction, component labeling, medial axis transform, skeletonization/thinning, shape properties, textural features – moments, gray level co-occurrence matrix, structural features, Fourier descriptor, polygonal approximation.

COMPRESSION:
Coding, quantization, spatial and transform domain based compression. Color image processing: color model, enhancement, and segmentation.

MATHEMATICAL MORPHOLOGY:

Basic concepts, erosion, dilation, opening, closing. Advanced applications like biomedical image processing, digital watermarking, etc

BOOKS RECOMMENDED:

1. R. C. Gonzalez and R. E. Woods, Digital Image Processing, Addison-Wesley, California, 1993.
2. Rosenfeld and A. C. Kak, Digital Picture Processing, Vol. 1 & 2, 2nd ed. Academic Press, Inc. 1982.
3. Chanda and D. Dutta Mazumdar, Digital Image Processing and Analysis, Prentice Hall of India, New Delhi, 2000.

MOBILE COMPUTING	**UCS07E08**
4 – 0 – 0 : Credits	Prerequisites: *None*

INTRODUCTION TO PERSONAL COMMUNICATIONS SERVICES (PCS):
PCS Architecture, Mobility management, Networks signaling.

GLOBAL SYSTEM FOR MOBILE COMMUNICATION (GSM) OVERVIEW:
GSM Architecture, Mobility management, Network signaling.

GENERAL PACKET RADIO SERVICES (GPRS):
GPRS Architecture, GPRS Network Nodes.

MOBILE DATA COMMUNICATION:
WLANs (Wireless LANs), IEEE 802.11 standard, Mobile IP, Bluetooth, Routing algorithms for mobile ad hoc networks

WIRELESS APPLICATION PROTOCOL (WAP):
The Mobile Internet standard, WAP Gateway and Protocols, wireless mark-up Languages (WML).

THIRD GENERATION (3G) MOBILE SERVICES:
Introduction to International Mobile Telecommunications 2000 (IMT 2000) vision, Wideband Code Division Multiple Access (W-CDMA), and CDMA 2000, Quality of services in 3G.

WIRELESS LOCAL LOOP (WLL):
Introduction to WLL Architecture, wireless Local Loop Technologies.

GLOBAL MOBILE SATELLITE SYSTEMS;
Case studies of the IRIDIUM and GLOBALSTAR systems.

TEXT BOOKS:

1. Yi-Bing Lin & Imrich Chlamtac, "Wireless and Mobile Networks Architectures", John Wiley & Sons, 2001.
2. Raj Pandya, "Mobile and Personal Communication systems and services", Prentice Hall of India, 2001.
3. U. Hansmann, "Principles of Mobile Computing", Wiley Dreamtech, 2004.

VLSI SYSTEM DESIGN	**UCS07E09**
4 – 0 – 0 : Credits	Prerequisites: *None*

Introduction to VLSI Design, Design styles and parameters, popular technologies. Logic implementation with NMOS, CMOS. DCVS and PLAs.

Pass vs. transistor logic, transit time, clocking, scaling, PLA minimization and folding, SIMPLIFY, ESPRESSO, Testability Issues.

Physical Design algorithms: Partitioning, Floor planning and placement, Routing, compaction, gate arrays, FPGAs, MCMs.

Data structures for layout designing -MAGIC. Design Rule checking, Expert systems, symbolic layout, and complexity of layout algorithms.

BOOKS RECOMMENDED:-

1. C.Mead & L.Conway: Introduction to VLSI Systems, Addison Wesley.
2. A.Mukherjee: Introduction to CMOS VLSI, Prentice Hall.
3. Fabricius: Introduction to VLSI Design, TMH.
4. T.Ohtsuki: Layout Design and Verification, North Holland.
5. N.Sherwani: Algorithms for VLSI Physical Design Automation, Kluwer Academic.
6. M.Sarrafzadeh & C.K.Wong:An Introduction to VLSI Physical Design, MH.

EIGHTH SEMESTER

Course Code	Course Name	L	T	P	Credits
UCS08C01	Distributed Systems	3	0	0	3
	Elective-IV	4	0	0	4
	Elective-V	4	0	0	4
	Elective-VI	4	0	0	4

UCS08P01	Project -II	0	2	6	6
UCS08P02	Grand Viva	0	0	0	4
	TOTAL	15	2	6	25

Total: Lectures = 15; Tutorial=2 ; Practical= 6 Total Credits= 25

Total Credits from 3rd to 8th Semester = 140

List of Electives

Eighth Semester Electives:

Course Code	Course Title	L	T	P	Credits
UCS08E01	Embedded & Real time Systems	4	0	0	4
UCS08E02	Pattern Recognition	4	0	0	4
UCS08E03	Object Oriented Analysis and Design	4	0	0	4
UCS08E04	Advanced Data Base Management System	4	0	0	4
UCS08E05	Parallel Processing	4	0	0	4
UCS08E06	Data Mining and Data Warehousing	4	0	0	4
UCS08E07	Multimedia Technology	4	0	0	4
UCS08E08	E-Commerce	4	0	0	4
UCS08E09	Natural Language Processing	4	0	0	4

N.B.: B – Basic Core, C – Departmental Core, E-Elective, P – Practical.
L- Lectures, T- Tutorials, S-Seminar

EIGHTH SEMESTER

DISTRIBUTED SYSTEM	**UCS08C01**
3 – 0 – 0 : 3 Credits	Prerequisites: *None*

CHARACTERIZATION OF DISTRIBUTED SYSTEMS:
Introduction, advantages and examples of distributed systems Models of distributed systems.

COMMUNICATION ISSUES:
External data representation and marshaling, client-server communication, peer-to-peer communication, remote procedure calls.

FUNDAMENTAL PROBLEMS IN DISTRIBUTED SYSTEMS:
Event ordering and logical clocks, global state collection, physical clock synchronization, mutual exclusion, leader election, termination detection, spanning tree construction, routing

FAULT TOLERANCE:
Fault models, types of tolerance, Agreement protocols, Reliable broadcast and multicast, Checkpointing and recovery

DISTRIBUTED FILE SYSTEMS:
File service architecture, case studies: Sun network file systems and Andrew file system.

NAME SERVICES:
Name services and the Domain Name System, Directory and Discovery Services.

DISTRIBUTED TRANSACTION:
Flat and Nested distributed Transaction, Atomic commit protocols, Concurrency control in distributed transactions, Distributed Deadlocks, Transaction recovery.

REPLICATION:
System model and group communication, Fault-tolerant services, highly available services, transactions with replicated data.

DISTRIBUTED SHARED MEMORY:
Design and Implementation Issues, Sequential consistency and Ivy, Release consistency and Munin, Other consistency models.

SECURITY IN DISTRIBUTED SYSTEMS:
Models, Authentication protocols – Kerberos

BOOKS RECOMMENDED:-

1. Distributed Systems: Concepts & Design by George Coulouris, Addison Wesley Pvt. Ltd.
2. Distributed Systems by Tanenbaum, Prentice Hall of India.
3. Distributed Operating Systems by Pradeep K. Sinha,Prentice Hall of India.
4. Distributed Systems & Networks by William Buchanan,Tata McGrawHill
5. Distributed Systems: An algorithmic approach by Sukumar Ghosh
6. Distributed Algorithms by Nancy Lynch

DETAILED SYLLABUS OF EIGHTH SEMESTER ELECTIVE SUBJECTS

EMBEDDED SYSTEM AND REAL TIME SYSTEM DESIGN	UCS08E01
4 – 0 – 0 : Credits	Prerequisites: *None*

INTRODUCTION TO EMBEDDED SYSTEMS:
Architecture of Embedded Systems - Hardware Architecture, Software Architecture, Communication Software, Development/Testing Tools. ASIC Design, PLA-PLD-CPLD-FPGA evolution,

EMBEDDED SYSTEM MODELING:
State chart, petri net, task graphs, UML, data flow graphs

PROGRAMMING EMBEDDED SYSTEMS:
The Process of Embedded System Development - Design Tradeoffs, Hardware Software co-design, Implementation, Integration and Testing. Hardware Platforms. Communication Interfaces.

EMBEDDED SYSTEM VALIDATION AND VERIFICATION

EMBEDDED/REAL-TIME OPERATING SYSTEMS:
Representative Embedded Systems, Suitability and Characteristics of operating systems for RT applications. Programming in RT-Linux. RT Rule based Expert System. Embedded Database Application. Mobile Java .

APPLICATIONS:
Embedded Software Development on 8051 Micro-controller Platform DSP-based Embedded Systems - Implementation of Embedded Systems with VHDL, FPGA and CPLD. Embedded Systems Applications using Strong ARM Platform

BOOKS RECOMMENDED:-

1. Embedded/Real-time Systems: Concepts, Design and Programming – Dr. K.V.K.K. Prasad, Dreamtech press.
2. Programming for Embedded Systems – Dreamtech Software team, Willey - dreamtech
3. Real time systems - Jane Liu, Prentice Hall
4. Real-Time Systems: Scheduling, Analysis, and Verification - by Prof. Albert M. K. Cheng, John Wiley and Sons
5. Embedded Systems: Principles, Techniques, and Applications – A. Konar, Springer 2011

PATTERN RECOGNITION	UCS08E02
4 – 0 – 0 : Credits	Prerequisites: *None*

INTRODUCTION:

Pattern recognition and learning (supervised, unsupervised), training and test sets, feature selection.

SUPERVISED LEARNING AND CLASSIFICATION:

Discriminant functions and decision boundaries Linear discriminant functions, relaxation procedure, non-separable behaviour Minimum distance classifier. Bayesian decision theory.Maximum likelihood classification. Parameter estimation, sufficient statistics, component analysis and discriminants (PCA, Fisher's) Nonparametric techniques. Density estimation, Parzen window, K-NN estimation, Supervised neural learning: Back-propagation algorithm, Radial basis-function neural net; Support vector machine classifier, Learning vector quantization

UNSUPERVISED LEARNING AND CLUSTERING:

Data description and clustering –similarity measures, criterion for clustering, Methods of clustering - partitional, hierarchical, graph theoretic, density based, k-means, k-mediod, fuzzy c-means clustering, Cluster validity

FEATURE EXTRACTION AND FEATURE SELECTION:

Problems of dimensionality- Feature extraction --PCA-Feature selection –Karhunen Loeve, stochastic approximation, kernel approximation, divergence measures, Independent component analysis.

BOOKS RECOMMENDED:-

1. R. O. Duda, P. E. Hart and D. G. Stork, Pattern Classification and Scene Analysis, 2nd ed., Wiley, New York, 2000.
2. J. T. Tou and R. C. Gonzalez, Pattern Recognition Principles, Addison-Wesley, London, 1974.
3. A. Konar, Computational Intelligence: Principles, Techniques, and Applications, Springer 2005.

OBJECT ORIENTED ANALYSIS AND DESIGN	**UCS08E03**
4 – 0 – 0 : Credits	Prerequisites: *None*

Object Oriented Programming (OOP) - Classes, Objects, Attributes, Methods, Messages, Abstraction, Encapsulation, Modularity, Inheritance, Generitance, Exception Handling. These concepts are to be introduced with reference to the language features of C++, Smalltalk and Java. [Parsons, Winston Budd]. OO Life Cycle Models, Object Oriented Analysis (OOA), Object Oriented Design (OOD), Object Oriented Testing, Metrics for Object Oriented Systems. [Pressman, Chapters 19-23]. OMT Methodology.

BOOKS RECOMMENDED:-

1. G.Booch: Object Oriented Design with Applications, 1991, Benjamin/Cummings.
2. T.Budd: An Introduction to Object Oriented Programming, Addison Wesley, 1990.
3. I.Jacobson: Object Oriented Software Engineering, Addison Wesley, 1992.
4. B.Meyer: Object Oriented Software Construction, 1988, 2nd Ed, Prentice Hall.
5. D. Parsons: Object Oriented Programming with C++, 1995, 2nd Ed., BPB Publications.
6. R.S. Pressman: Software Engineering, 1972, 4th Ed., McGraw Hill
7. P.H. Winston and S. Narashimhan: on to Java, 1996, Addison - Wesley.
8. R. Wirfs-Brock and others: Designing Object Oriented Software, Prentice Hall, 1990.
9. E.Yourdon: Object Oriented System Design, 1994, Prentice Hall

ADVANCED DATABASE MANAGEMENT SYSTEM	**UCS08E04**
4 – 0 – 0 : Credits	Prerequisites: *None*

RELATIONAL DATABASES, INTEGRITY CONSTRAINTS REVISITED:
Functional, Multi-valued and Join Dependency, Template Algebraic, Inclusion and Generalized Functional Dependency, Chase Algorithms and Synthesis of Relational Schemes.

QUERY PROCESSING AND OPTIMIZATION:
Evaluation of Relational Operations, Transformation of Relational Expressions, Indexing and Query Optimization, Limitations of Relational Data Model, Null Values and Partial Information.

DEDUCTIVE DATABASES:
Datalog and Recursion, Evaluation of Datalog program, Recursive queries with negation.

OBJECTED ORIENTED AND OBJECT RELATIONAL DATABASES:
Modeling Complex Data Semantics, Specialization, Generalization, Aggregation and Association, Objects, Object Identity, Equality and Object Reference, Architecture of Object Oriented and Object Relational Databases.

CASE STUDIES:
Gemstone, O2, Object Store, SQL3, Oracle xxi, DB2.

PARALLEL AND DISTRIBUTED DATABASES:
Distributed Data Storage: Fragmentation and Replication, Location and Fragment Transparency, Distributed Query Processing and Optimization, Distributed Transaction

Modeling and Concurrency Control, Distributed Deadlock, Commit Protocols, Design of Parallel Databases, Parallel Query Evaluation.

ADVANCED TRANSACTION PROCESSING:
Nested and Multilevel Transactions, Compensating Transactions and Saga, Long Duration Transactions, Weak Levels of Consistency, Transaction Work Flows, And Transaction Processing Monitors.

ACTIVE DATABASES: Triggers in SQL; event constraint and action**:** ECA Rules, Query Processing and Concurrency Control, Compensation and Databases Recovery.

REAL TIME DATABASES; TEMPORAL CONSTRAINTS:
Soft and Hard Constraints, Transaction Scheduling and Concurrency Control.

IMAGE AND MULTIMEDIA DATABASES:
Modeling and Storage of Image and Multimedia Data, Data Structures - R-tree, k-d tree, Quad trees.

CONTENT BASED RETRIEVAL:
Color Histograms, Textures etc, Image Features, Spatial and Topological Relationships, Multimedia Data Formats, Video Data Model, Audio and Handwritten Data, Geographic Information Systems (GIS).

WEB DATABASES:
Accessing Databases through WEB, WEB Servers, XML Databases,

COMMERCIAL SYSTEMS:
Oracle xxi, DB2.

DATA MINING:
Knowledge Representation Using Rules, Association and Classification Rules, Sequential Patterns, Algorithms for Rule Accessing.

BOOKS RECOMMENDED:-

1. Database System Concepts, 6th Ed. Avi Silberschatz, Hank Korth, and S. Sudarshan. McGraw Hill,
2. Elmasri, Navathe. Fundamentals of Database Systems, Third Edition, Pearson Education, 2000.
3. T. Connolly, C. Begg, Database Systems, 3/e, Pearson Education, 2003.
4. Ullman J. D., Principles of Database Systems, Galgotia Publications,1996.
5. Jiawei Han and Micheline Kamber, Data Mining: Concepts and Techniques, Morgan Kaufmann Publishers

PARALLEL PROCESSING	**UCS08E05**

4 – 0 – 0 : Credits	Prerequisites: *None*

INTRODUCTION TO HIGH PERFORMANCE COMPUTING:
Milestones and applications. High-Performance Computing architectures: Overview of the major classes of HPC architectures and their evolution.

PARALLEL PROGRAMMING MODELS AND PERFORMANCE ANALYSIS:
Parameterization, modeling, performance analysis, Amdahl's law, efficiency, and benchmarking of systems.

PROGRAMMING PARALLEL COMPUTERS:
Overview of parallel programming, parallel languages, parallelizing compilers, message passing and data parallel programming models, introduction to MPI and OpenMP.

MULTI-THREAD MODELS:
Multi-Process and multi-threaded Execution Model; Performance Tuning via Overhead Reduction; Task Scheduling; Data Partitioning and its effect on performance.

RESTRUCTURING FOR PARALLEL PERFORMANCE:
Loop Transformations; Data Transformations; Dependence Analysis; Compiler Strategies.

PARALLEL ALGORITHMS :
Cyclic Reduction; Iterative Algorithms (Jacobi, Gauss-Seidel and Red-Black Orderings); Divide-and-Conquer Algorithms, Adaptive Quadrature etc.

INTRODUCTION TO CLUSTER, GRID, AND CLOUD COMPUTING

BOOKS RECOMMENDED:-

1. Introduction to Parallel Computing, Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar, 2nd edition, Addison-Welsey, 2003.
2. Petascale Computing: Algorithms and Applications, David A. Bader (Ed.), Chapman & Hall/CRC Computational Science Series, 2007.
3. Parallel Programming in C with MPI and OpenMP by M.J. Quinn, McGraw-Hill Science/Engineering/Math
4. Advanced Computer Architecture- Kai Hwang- McGraw Hill

DATA MINING AND DATA WAREHOUSING	UCS08E06
4 – 0 – 0 : Credits	Prerequisites: *None*

OVERVIEW & CONCEPTS:
Need for data warehousing, basic elements of data warehousing, Trends in data warehousing.

PLANNING &REQUIREMENTS:
Project planning and management, Collecting the requirements. Architecture & Infrastructure: Architectural components, Infrastructure and metadata.

DATA DESIGN AND DATA REPRESENTATION:
Principles of dimensional modeling, Dimensional modeling advanced topics, data extraction, transformation and loading, data quality.
Information Access & Delivery: Matching information to classes of users, OLAP in data warehouse, Data warehousing and the web.
Implementation And Maintenance: Physical design process, data warehouse

INTRODUCTION:
Basics of data mining, related concepts, Data mining techniques.

DATA MINING ALGORITHMS:
Classification, Clustering, Association rules.

KNOWLEDGE DISCOVERY:
KDD Process

WEB MINING:
Web Content Mining, Web Structure Mining, Web Usage mining.

ADVANCED TOPICS:
Spatial mining, temporal mining.

VISUALIZATION:
Data generalization and summarization-based characterization, Analytical characterization, analysis of attribute relevance, mining class comparisons: Discriminating between different classes, mining descriptive statistical measures in large databases
Data Mining Primitives, Languages, and System Architectures: Data mining primitives, Query language, Designing GUI based on a data mining query language, Architectures of data mining systems , Application and Trends in Data Mining: Applications, Systems products and research prototypes, Additional themes in data mining, Trends in data mining

BOOKS RECOMMENDED:-

1. Adriaans, P. (1996), Data mining, Addison-Wesley

2. Jiawei Han and Micheline Kamber, Data Mining: Concepts and Techniques, Morgan Kaufmann Publishers
3. Paulraj Ponnian, "Data Warehousing Fundamentals", John Wiley.
4. M.H. Dunham, "Data Mining Introductory and Advanced Topics", Pearson Education
5. Margaret Dunham, "Data Mining: Introductory and Advanced Topics", Prentice Hall
6. Weiss, Sholom "M. - Predictive data mining: a practical guide" / Sholom M. Weiss, Nitin Indurkhy. - San Francisco, Calif. : Morgan Kaufmann Publishers, 1998. - 1558604030
7. Advances in knowledge discovery and data mining / edited by Usama M. Fayyad. - Menlo Park, Calif. : AAAI Press; Cambridge, Mass.; London : MIT
8. Thomsen, Erik, 1959, "OLAP solutions : building multidimensional information systems" / Erik Thomse. - 2nd ed. - New York; Chichester : Wiley
9. Mitchell, Tom M., Tom Michael, 1951-. - Machine learning / Tom M. Mitchell. - New York; London : McGraw-Hill
10. Ralph Kimball, "The Data Warehouse Lifecycle toolkit", John Wiley.
11. M Berry and G. Linoff, "Mastering Data Mining", John Wiley.
12. W.H. Inmon, "Building the Data Warehouses", Wiley Dreamtech.
13. R. Kimpall, "The Data Warehouse Toolkit", John Wiley
14. Konar A., Artificial Intelligence and Soft Computing, CRC Press, 2000

MULTIMEDIA TECHNOLOGY	**UCS08E07**
4 – 0 – 0 : Credits	Prerequisites: *None*

MULTIMEDIA TECHNOLOGY:
Introduction, Nature of Multimedia Data, Multimedia Peripherals & Devices, Storage of Multimedia Data

MULTIMEDIA SYSTEMS DESIGN :
An Introduction – Multimedia applications – Multimedia System Architecture – Evolving technologies for Multimedia – Defining objects for Multimedia systems – Multimedia Data interface standards – Multimedia Databases.

DIFFERENT DATA COMPRESSION TECHNIQUES:
Runlength encoding, quantization, wavelet transform, JPEG 2000 image compression, vector quantization and codebook method a Temporal Model for Interactive Multimedia,

MULTIMEDIA FILE HANDLING :
Compression & Decompression – Data & File Format standards – Multimedia I/O technologies - Digital voice and audio – video image and animation – Full motion video – Storage and retrieval Technologies.

MULTIMEDIA DATABASES AND CLUSTERING:

Clustering for Multimedia Object Storage, Clustering Algorithms, Querying and Content Retrieval in Multimedia Databases, Distributed Multimedia Systems.

HYPERMEDIA :

Multimedia Authoring & User Interface – Hypermedia messaging - Mobile Messaging – Hypermedia message component – creating Hypermedia message – Integrated multimedia message standards – Integrated Document management

BOOKS RECOMMENDED:-

1. J. Keyes: Multimedia Handbook, MH.
2. G. Blair, L. Blair, A. Chetwynd, H. Bowman: Formal Specification of Distributed Multimedia Systems, UCL Press, London.
3. S. Khoshafian, A. Brad Baker: Multimedia and Imaging Databases, Morgan Kaufmann.

E-COMMERCE	**UCS08E08**
4 – 0 – 0 : Credits	Prerequisites: *None*

INTRODUCTION AND BUSINESS MODELS FOR E-COMMERCE

Worldwide E-commerce Growth Early Business Information Interchange Efforts Emergence of the Internet Emergence of the World Wide Web The Milestones Advantages of E-commerce Disadvantages of E-commerce Online Extension of a BAM Model Transition to Ecommerce in India The Internet and India E-transition Challenges for Indian Corporate The Information Technology Act, 2000 The Birth of Portals E-business Models Based on the Relationship of Transaction Parties E-business Models Based on the Relationship of Transaction. Types baazee.com chennaibazaar.com automartindia.com sulekha.com tatasteel.com sify.com eGurucool.com

ENABLING TECHNOLOGIES OF THE WORLD WIDE WEB

- Internet Client-Server Applications Networks and Internets Transmission Control Protocol Software Agents Internet Standards and Specifications.
- Internet Service Provider (ISP) Broadband Technologies Hypertext JavaScript XML

APPLICATIONS I

E-marketing E-advertising Internet Marketing Trends Target Markets E-branding Marketing Strategies E-security Security on the Internet E-business Risk Management Issues Epayment Systems Digital Payment Requirements Digital Token based E-payment Systems Classification of New Payment Systems Properties of Electronic Cash (E-cash) Cheque Payment Systems on the Internet Risk and E-payment Systems Designing E-payment

Systems Digital Signature Online Financial Services in India Online Financial Services in India.

APPLICATION II

E-Customer Relationship Management Customer Relationship Management Typical Business Touch-points *Orbitz* ESupply Chain Management Supply Chain E-strategy Information and Strategy The Virtual Value Chain Seven Dimensions *of* Ecommerce Strategy Value Chain and E-strategy Planning the Ecommerce Project E-Commerce Strategy and Knowledge Management E-Business Strategy and Data Warehousing and Data Mining Mobile Commerce Growth *of* Mobile Commerce Success Stories *of* Mobile Commerce Wireless Applications Technologies for Mobile Commerce Origins of WAP, WAP Programming Model Wireless Technologies Customer-effective Web Design Requirements of Intelligent Websites Setting Website Goals and Objectives Strategies for Website Development Legal and Ethical Issues

BOOKS RECOMMENDED:-

1) P. T. Joseph S.J: "E-Commerce –An Indian Perspective", Second Edition, PHI – 2005
2) Daniel Minoli, Emma Minoli: "Web Commerce Technology", Tata McGraw Hill 2000
3) Turban, "E-Commerce", Pearson, New Delhi.
4) Kalakota and Whinston, "Frontiers of E-commerce", Pearson Education Asia, 2000.

NATURAL LANGUAGE PROCESSING	UCS08E09
4 – 0 – 0 : Credits	Prerequisites: *None*

PARSING & GRAMMAR:

Lexical Functional Grammar, Tree Adjoining Grammar, Government & Binding, Paninian Grammar. Comparison of Paninian Grammar with others.

SEMANTIC INTERPRETATION:

Logical Semantics, Script, Conceptual Dependency.

DISCOURSE INTERPRETATION:

Paragraph, Story, Dialogue understanding. Anaphora Resolution.

NATURAL LANGUAGE GENERATION:

Machine Translation with special reference to Indian Languages.

NLP SYSTEMS:

Natural language interfaces to databases.

Introduce more new research oriented topics, topics of current research which will focus on the state- of-the-art in various areas of Natural Language Processing.

BOOKS RECOMMENDED:-

1. Grasz, Jones & Webber (Ed.): Readings in Natural Language Processing, Morgan Kaufmann, 1986.
2. Gazdar & Mellish: Natural Language Processing in PROLOG, Addision Wesley, 1989.
3. Leonard Bolc. (Ed.): Natural Language Parsing Systems, Springer Verlag, 1987.
4. McDonald & Bolc. (Ed.): Natural Language Generation Systems, Springer Verlag, 1987.
5. W. J. Hutchins: Machine Translation - Past, Present & Future, Ellis Horwood, 1986.
6. Bharati, Chaitanya and Sangal: Natural Language Processing- a Paninian perspective, PHI, 1985.