DEPARTMENT OF COMPUTER ENGINEERING
NATIONAL INSTITUTE OF TECHNOLOGY CALICUT

Brief Syllabi for B.Tech (Computer Science and Engineering)
(From 2006 Admissions)

PART I : CORE COURSES

CSU 101 COMPUTER PROGRAMMING

Pre-requisite: NIL

L	T	P	Cr
3	0	0	3

Introduction to computers and software, Problem solving, algorithm design, and algorithm analysis (mention only), Design methodologies, Stepwise refinement, Modules and Interfaces, Object oriented methodology: Encapsulation, Inheritance, Polymorphism, Programming language concepts and constructs: Expressions, Statements, selection, repetition, Functions, recursion, I/O mechanisms (Exceptions optional), Data types: Primitive types and structured types, Coding practices: Indentation guidelines, naming conventions, documenting code, debugging, Testing: Verification methods, test data selection.

Note: Programming language C++ / Java may be used as a vehicle to achieve the goal.

Text Books:
1. Bruce Eckel, *Thinking in Java*, 3/ed.
Available online at www.bruceeckel.com
2. Bruce Eckel, *Thinking in C++,* 2/ed. Vol I and II.
Available online at www.bruceeckel.com

References:
1. Robert Lafore, *Object Oriented Programming in Turbo C++,* The Waite Group's, Galgotia Publications Pvt. Ltd. 2000.
2. Rebecca Thomas, Lawrence R Rogers, Jean L Yates, *Advanced Programmer's Guide to UNIX System V*,
McGraw Hill International Edition, Computer Science Series.
3. Patrick Naughton, Herbert Schildt, *Java ™ 2:The Complete Reference*, Tata McGraw-Hill Publishing Company
Ltd. 3/ed
4. Danny Kalev, *The ANSI/ISO C++ Professional Programmer's Handbook*, PHI 2000.

MAU 201 MATHEMATICS II1 (PROBABILITY & STATISTICS)

Prerequisite: MAU 101 Mathematics I

L	T	P	Cr
3	1	0	3

Probability distributions: - Random variables, Probability distributions, discrete random variables and continuous random variables and their probability distributions. Sampling distributions and statistical inference:- Population and sample, The sampling distributions of the mean , sampling distributions of the variance, Maximum Likelihood Estimation, point estimation, interval estimation, Tests of hypotheses associated with one mean, two mean, one variances, two variances, Estimations of proportions, Hypothesis concerning one proportion, Hypothesis concerning several proportions , Analysis of r x c tables, Chi – square test for goodness of fit. Bi-Variate Normal distribution-joined, marginal land conditional distributions , Curve fitting, Method of least squares, Estimation of regression models, Correlation – estimation of correlation coefficient. General principles of analysis of variance, completely randomized designs, Randomized block diagram, Latin square designs, Analysis of covariance.

Text Book:

Johnson, R.A. Miller and Freund's Probability and Statistics for Engineers, 6th edn., PHI, 2004.

References:

1. Levin R.I. & Rubin D.S., Statistics for Management, 7th edn, PHI, New Delhi, 2000.
2. S.M. Ross, Introduction to Probability and statistics for Engineers, 3rd edn, Academic Press(Elsevier), Delhi, 2005.

EEG 204   ELECTRICAL CIRCUITS & SYSTEMS

Prerequisite: EEU 102 Basic Electrical Engineering

L	T	P	Cr
3	0	0	3

Electric Circuit Parameters, Sinusoidal and Steady State Analysis, LapLace Transform Analysis of Simple Electric Circuits, Review of Electric Network Theorems, Network Graph Theory, Introduction to Control Systems, Open Loop & Closed Loop Control Systems,

References:

1. Ogata K: *Modern Control Engineering*, Prentice Hall
2. J.J. D.Azzo, C.H. Houpis. : *Feed Back Control System Analysis & Synthesis*, Mcgraw Hill, Japan.
3. A Chakrabarti. : *Circuit Theory*, Dhanpat Rai & Co., New Delhi.
4. Sundaran, Seshi, Bala Banean,: *Network Theory*, Prentice Hall.
5. Hayt and Kemmerly: *Engineering Circuit Analysis*, McGraw Hill.
6. Hughes E : *Electrical Technology*, ELBS.

7. Cotton H: *Advanced Electrical Technology*, CBS Publishers & Distributors.

ECG 204 ELECTRONIC CIRCUITS & SYSTEMS

Prerequisite: ECU 101 Basic Electronics Engineering

L	T	P	Cr
3	0	0	3

Bipolar junction Transistor, Biasing, Small signal Amplifiers, Classification of amplifiers, *Field Effect Transistors,* Power Amplifiers, Feedback in Amplifiers, Oscillators, Operational Amplifiers, analog computation, active filters, A/D converters, Multivibrators, Schmitt trigger, Miller & Bootstrap Time base generators, 555 Timer circuits, *Logic families*

References :

1. J. Millman and C. Halkias, *Integrated Electronics: Analog and Digital Circuits and systems*, Tata McGraw Hill, New Delhi, 1972.
2. D.L.Schilling and C. Belove, *Electronic circuits: Discrete and Integrated,* McGraw Hill, Singapore, 1985.
3. Sergio Franco, *Design with Operational Amplifiers and Analog Integrated Circuits,* McGraw Hill.
4. Jacob Millman and Herbert Taub, *Pulse, digital and Switching Waveforms*, McGraw Hill, 1965.
5. H.Taub and D.Schilling, Digital Integrated Electronics, McGraw Hill, 1978.
6. Robert Boylestad and Louis Nashelsky: *Electronic Devices and Circuit Theory,* Prentice Hall India Ltd.
7. T.Bogart : Electronic Devices and Circuits, Universal Book Stall, New Delhi

CSU 212 COMPUTATIONAL COMBINATORICS

Pre-requisite: NIL

L	T	P	Cr
3	0	0	3

Principles of counting – permutations, combinations. Pigeon hole principle. Discrete probability, Generating Functions, Partitions of Integers, Recurrence Relations .The First-Order and Second Order Linear Recurrence Relation The Non homogeneous Recurrence Relation, Graphs: Paths and Circuits, Hamilton Paths and Cycles. Graph Coloring and Chromatic Polynomials, Planarity. Network Flows, Transport Networks. The Max-Flow Min-Cut Theorem. Matching Theory.

References:
1. Grimaldi R. P. Discrete and Combinatorial Mathematics, 5/e, Addison Wesley, 2002.
2. Thomas Koshy. Discrete Mathematics with Applications, Academic Press, Elsevier, 2004.
3. Kenneth H Rosen. Discrete Mathematics and its Applications. McGraw Hill, 2000.
4. Ravindra K. K. Ahuja, Thomas L. Magnanti, James B. Orlin. Network Flows: Theory, Algorithms, and Applications. Prentice Hall, 1993.

CSU 202   LOGIC DESIGN

Pre-requisite: CSU 101 Computer Programming

L	T	P	Cr
3	0	2	4

Number Systems and codes, Boolean algebra: postulates, switching algebra, *Boolean functions and logical operations*, *Karnaugh map,* Quine-McClusky algorithm, Combinational Logic: analysis and design of combinational logic circuits, PLAs, PLA minimization, Counters and shift registers, design of sequential circuits, shift registers and their applications, Microprocessor architecture, real mode and protected mode memory addressing, Addressing modes: data addressing, program memory addressing, stack memory addressing. Data movement instructions, Arithmetic and logic instructions, Program control instructions, Programming the microprocessor: modular programming, using keyboard and display, using assembly language with C/C++, Memory interface: memory devices, address decoding, Hardware architecture for embedded systems, Memory interfaces, dynamic RAM. I/O interface, Interrupts-Interrupt controller, DMA Controller.

 References:

1. N. N. Biswas, *Logic Design Theory*, Prentice Hall of India, New Delhi, 1993.
2. T. L. Floyd, *Digital Fundamentals*, 3/e, Universal Book Stall, New Delhi, 1986.
3. B. B. Brey*, The Intel Microprocessors 8086 to Pentium: Architecture, Programming and Interface*, 6/e, Prentice Hall of India, New Delhi, 2003.
4. Programming for embedded systems Dream Software team , Willey 2002
5. H. P. Messmer, *The Indispensable PC Hardware Book*, 3/e, Addison Wesley, 1997.
6. A. K. Ray, and K. M. Bhurchandi, Advanced Microprocessors and Peripherals, Tata McGraw Hill, 2000.
7. D. V. Hall, *Microprocessors and Interfacing: Programming and Hardware*, 2/e, Tata McGraw Hill, New Delhi, 1992.

CSU 230 PROGRAM DESIGN

Pre-requisites: CSU 101 Computer Programming, Knowledge of Graphs and Trees

L	T	P	Cr
3	0	2	4

Review of Programming Constructs- Conditional and Iterative constructs, Data types, Control Structures, Functions, Parameter passing- calling conventions, Recursion, Asymptotic notation for complexity analysis, Pointers and dynamic memory allocation, Abstract Data Types, Lists, Stacks, Queues, Trees, Search Trees and traversal algorithms, Heaps and Priority queues, Searching - Linear and Binary, Sorting- Insertion and Selection sorting, Divide an conquer, Quick sort, Merge Sort, Heap Sort, External Sorting, Memory Management, Garbage collection algorithms, Buddy systems, Storage compaction.

References:
1. Aho A.V., Hopcroft J.E., and Ullman J.D., *Data Structures and Algorithms*, Pearson Education, New Delhi, 1983.
2. Cormen T.H., Leiserson C.E, Rivest R.L. and Stein C, *Introduction to Algorithms*, Prentice Hall India, New Delhi, 2004
3. Sahni S., *Data Structures, Algorithms, and Applications in C++,* Mc Graw Hill, Singapore, 1998.
4. Wirth N., *Algorithms +Data Structures = Programs*, Prentice Hall India, New Delhi, 1976.

ECG 291 ELECTRONICS LAB

Prerequisite: ECU 101 Basic Electronics Engineering

L	T	P	Cr
0	0	3	2

Electronics Workshops, diode characteristics, UJT and UJT relaxation oscillator, transistor characteristics, wave shaping circuits, Series voltage regulator, Frequency response of CE amplifier, measurement of input and output impedance, oscillator, Op Amp.

Reference:
J.Millman and C. Halkias, *Integrated Electronics: Analog and Digital Circuits and systems*, Tata McGraw Hill, New Delhi, 1972

CSU 297 HARDWARE LAB

Pre-requisites: Knowledge of Digital Electronics and Assembly Language Programming

L	T	P	Cr
0	0	3	2

Digital electronics (12 Hours)
Sequential circuits-Flip flops-shift registers-ring counters and Johnson counter-synchronous and asynchronous counters
80X86 Assembly language programming:
Integer operations-recursive subroutines-two dimensional arrays. (9 Hours)
String manipulation, floating point operations. (6 Hours)
DOS and BIOS interrupts. (6 Hours)
Embedded system experiments (RTLinux). (9 Hours)

References:

1. B. B. Brey*, The Intel Microprocessors 8086 to Pentium: Architecture, Programming and Interface*, 6/e, Prentice Hall of India, New Delhi, 2003.
2. Programming for embedded systems Dream Software team , Willey 2002
3. The art of Assembly language programming   Randy Hyde

MAU 202 MATHEMATICS IV

Prerequisite: MAU 101, MAU 102

L	T	P	Cr
3	1	0	3

Series solutions and special functions, Strum-Liouville's Problems Partial Differential Equations, Charpit's Method, Wave equation, Heat equation and Laplace equation,Analytic functions, Conformal mapping, Complex integration, Taylor, Maclaurin's and Laurent's series , Calculus of residues.

Text Book:
  Kreyszig E, Advanced Engineering Mathematics, 8th Edition, John Wiley & Sons,New York, 1999.
Reference Books:
1. I.N. Sneddon, Elements of Partial Differential Equations, Dover   Publications, 2006.
2. Wylie C.R. & Barret L.C., Advanced Engineering Mathematics, 6th Edition, Mc Graw Hill, New York, 1995.
3. Donald W.Trim, Applied partial differential equations, PWS-KENT publishing company, 1994.

CSU 211 FORMAL LANGUAGES AND AUTOMATA

Pre-requisites: NIL

L	T	P	Cr
3	0	0	3

Basic concepts of Languages, Automata and Grammar. Regular Languages - Regular expression - finite automata equivalence, Myhill Nerode theorem and DFA State Minimization, Pumping   Lemma and proof for existence of non-regular languages. Context Free languages, CFL-PDA equivalence, Pumping Lemma and proof for existence of non- Context Free languages, CYK Algorithm, Deterministic CFLs, Turing Machines: recursive and recursively enumerable languages, Universality of Turing Machine, Church Thesis, Chomsky Hierarchy, Undecidability, Reducibility.

References:
1. M. Sipser, Introduction to the Theory of Computation, Thomson, 2001.
2. Hopcroft J. E., Rajeev Motwani, and Ullman J. D., Introduction to Automata Theory, Languages and Computation, Pearson Education Asia,2001.
3. J. C. Martin, Introduction to Languages and the Theory of Computation, Mc Graw Hill, 2002.
4. P. Linz, Introduction to Formal Languages and Automata, Narosa,1998

CSU 201 DISCRETE COMPUTATIONAL STRUCTURES

Pre-requisite: CSU 212 Computational Combinatorics

L	T	P	Cr
3	0	0	3

Review of set theory, induction. Logic: Basic connectives and truth tables, laws of logic, rules of inference, qualifiers, proofs of theorems, Relations and Functions, properties of relations, partial ordering, equivalence relations, lattices, Boolean algebra, Groups: Definitions and properties, homomorphisms, isomorphisms and cyclic groups, Coset's and Lagrange's Theorem, linear codes, Rings: Definitions, ring properties and substructures, properties of integers, the integer modulo n, ring homomorphism and isomorphism, polynomial rings, finite fields.

Text Books:
1. Grimaldi R. P., *Discrete and Combinatorial Mathematics*, 4/e, Pearson Education, New Delhi, 1999
2. B. Kolman and R.C. Busby, *Discrete Mathematical Structures for Computer Science*, PHI, New Delhi, 1994.

References:
1. Truss J. K., *Discrete Mathematics for Computer Scientists*, Pearson Education, New Delhi, 1999
2. C. L. Liu C. L., *Elements of Discrete Mathematics*, 2/e, McGraw Hill, Singapore, 1985
3. J. L. Mott J. L., Kandel A and Baker T. P., *Discrete Mathematics for Computer Scientists and Mathematicians*, 2/e, Prentice Hall of India, New Delhi, 1986.

CSU 213 DATABASE MANAGEMENT SYSTEMS

Pre-requisite: CSU 212 Computational Combinatorics / MAG 501 Discrete Mathematics

L	T	P	Cr
3	0	0	3

Database System Concepts and Architecture, Data Modeling using ER model, Relational data model, Relational algebra and Relational calculus, SQL, Relational database design using ER to relational mapping, Database design theory and Methodology, Functional Dependencies and Normal Forms, Relational Database Design algorithms, Data storage, Indexing and physical design, Transaction processing concepts, Concurrency Control, Introduction to Database Security.

1References:
1. Elmasri & Navathe, *Fundamentals of Database Systems*, 4th Edition, Pearson Education
2. Ramakrishnan R. & Gehrke J., *Database Management Systems*, 3/e, McGraw Hill

CSU 203 DATA STRUCTURES AND ALGORITHMS

Pre-requisites: CSU 230 Program Design
CSU 212 Computational Combinatorics / MAG 503 Graph Theory and Combinatorics

L	T	P	Cr
3	0	0	3

Review of basic data structures, Representation of sets, Hashing, Disjoint sets. Graphs: Representation of graphs, Traversals, Minimum Cost Spanning Tree algorithms, Path Finding algorithms. Balanced Binary Search trees: Red-Black trees, B-Trees. Binomial Heaps, Fibonacci heaps.

Text Book:
   Cormen T.H., Leiserson C.E, Rivest R.L. and Stein C, *Introduction to Algorithms*, Prentice Hall India, New Delhi, 2004
References:
1.   Aho A.V., Hopcroft J.E., and Ullman J.D., *Data Structures and Algorithms*, Pearson Education, New Delhi, 1983.
2.   Sahni S., *Data Structures, Algorithms, and Applications in C++,* Mc Graw Hill, Singapore, 1998.
3.   Wirth N., *Algorithms +Data Structures = Programs*, Prentice Hall India, New Delhi, 1976.

CSU 215 COMPUTER ORGANISATION

Pre-requisite: CSU202 Logic Design

L	T	P	Cr
3	0	2	4

Computer abstraction and technology, measuring performance, Instructions, Computer arithmetic, constructing an ALU, multiplication and division, floating point representation and arithmetic, processor, Memory hierarchy: caches, virtual memory, Input/output, buses.

References:
1. D. A. Pattersen and J. L. Hennesy, *Computer Organisation and Design: The Hardware/ Software Interface*, 3/e, Morgan Kaufman, Singapore, 2004.
 2. V. P. Heuring and H. F. Jordan, *Computer System Design and Architecture*, Addison Wesley, New Delhi, 1997.

CSU 291 DATA STRUCTURES LAB

Prerequisite: CSU230 Program Design

L	T	P	Cr
0	0	5	3

Stack and Queue: Implementation using arrays and Linked lists, Searching Methods: Binary search and Hashing Sorting: Recursive implementation of Quick Sort and Merge Sort, Binary Search Tree: Implementation with insertion, deletion and traversal, Infix Expression Evaluation: Using expression tree, Graph Search Algorithms: DFS and BFS on a connected directed graph, Minimal Spanning Tree: Implementation of Kruskal's and Prim's Algorithms, Shortest Path Algorithms: Dijkstra and Floyd Warshall Algorithms, Disjoint Set operations: Union and Find using rank and path compression., Applications of Heap: Priority Queue and Heap Sort.

References:
1. T. H. Cormen, C. E. Lieserson, R. L. Rivest, *Introduction to Algorithms*, PHI, 1998
2. S. Sahni, *Data structures, Algorithms, and Applications in C++*, McGraw Hill, 1998

CSU 296 DBMS LAB

Pre-requisite: Knowledge of database design and applications

L	T	P	Cr
0	0	3	2

Familiarization of MySQL – creation and manipulation of tables.

Analyze a given situation, develop an ER model and convert the ER model to Relational model. Implement the database using MySQL and manipulate the tables using SQL commands.

Development of a 2 tier application using a suitable front end.

Development of a 3 tier application involving manipulation of web databases.

Imple mentation of B Trees and B+ Trees, implementation of a single user RDBMS called 'Minibase', Write codes for both logical layer and physical layer.

References:
1. Elmasri, Navathe, *'Fundamentals of Database Systems',* 4/e, Pearson Education
2. Reghu Ramakrishnan*, Databse Management Systems,* McGrawHill
3. *http://www.cs.wisc.edu/coral/minibase/minibase.html*

CSU 301   DESIGN AND ANALYSIS OF ALGORITHMS

Pre-requisite: CSU203 Data Structures & Algorithms

L	T	P	Cr
3	0	0	3

Algorithm Analysis: Space and Time Complexities, Asymptotic notations, Analysis of recursive algorithms, probabilistic analysis, amortized analysis. Algorithm Design Paradigms: Brute Force, Divide and Conquer, Dynamic, Greedy, Back Tracking, Branch and Bound. Complexity Classes: P, NP, NP-hard and NP-complete problems, reductions. Approximation Algorithms. Probabilistic algorithms.

Text Books:
1. Cormen T.H., Leiserson C.E, Rivest R.L. and Stein C, *Introduction to Algorithms*, Prentice Hall India, New Delhi, 2004.
2. Motwani R. & Raghavan P., *Randomized Algorithms,* Cambridge University Press.

References:
1. Anany Levitin, *Introduction to the Design & Analysis of Algorithms*, Pearson Education. 2003
2. Basse S., *Computer Algorithms: Introduction to Design And Analysis*, Addison Wesley.
3. Manber U.*, Introduction to Algorithms: A Creative Approach*, Addison Wesley
4. Aho A. V., Hopcroft J. E. & Ullman J. D., *The Design And Analysis of Computer Algorithms*, Addison Wesley

CSU 302 NUMBER THEORY AND CRYPTOGRAPHY

Prerequisite: CSU201 Discrete Computational Structures

L	T	P	Cr
3	0	0	3

Divisibility theory, theory of congruences, Fermat's theorem,Wilson's theorem, , Euler's theorem, Chinese remainder theorem, Primitive roots and indices, Fermat's last theorem, primality testing, Finite fields, polynomial arithmetic, quadratic residues, zero knowledge protocols, elliptic curve arithmetic, recent developments in number theory. Introduction to secure computing, DES, block cipher modes of operation, triple DES, AES, key distribution RSA cryptosystem, Diffie-Hellman, elliptic curve cryptosystem, data integrity and authentication, MD5 message digest algorithm, secure hash algorithm, digital signatures, digital signature standard.

References:
1. Niven I., Zuckerman H.S. and Montgomery H. L., *An Introduction to the Theory of Numbers*, 5/e, John Wiley and Sons, 2004.
2. Stallings W., *Cryptography and Network Security: Principles and Practice*, 4/e, Pearson Education Asia, 2006.
3. Mano W., *Modern Cryptography: Theory & Practice*, Pearson Education, 2004.

CSU 303 COMPILER CONSTRUCTION

Pre-requisites: CSU 203 Data Structures and Algorithms
CSU 211 Formal Languages and Automata

L	T	P	Cr
3	0	0	3

Lexical analysis: Specification and recognition of tokens. Syntax analysis: Top-down parsing-Recursive descent and Predictive Parsers. Bottom-up Parsing- LR (0), SLR, and LR (1) Parsers. Semantic analysis: Type systems, type checking, and symbol tables. Intermediate code generation: Intermediate representation-Three address code and quadruples. Syntax-directed translation of declarations, assignments statements, conditional constructs, and loops constructs. Runtime Environments: Storage Organization, activation records. Introduction to machine code generations and code optimizations.

References:
1. Aho A.V., Sethi R, and Ullman J.D. Compilers: Principles, Techniques, and Tools, Addison-Wesley, 1986.
2. Appel A.W, and Palsberg J. Modern Compiler Implementation in Java. Cambridge University Press, 2002.

CSU 304 COMPUTER NETWORKS

Pre-requisite: CSU 203 Data Structures and Algorithms / CSU 230 Program Design

L	T	P	Cr
3	0	0	3

Physical layer, Link layer services, error detection and correction, Ethernet, hubs, bridges, switches, wireless links, Transport layer services, UDP and TCP, Network layer services, routing, IP, Internet, Application layer protocols, Network Security, Protocols, Firewalls.

References:
1. J. F. Kurose and K . W. Ross, *Computer Networking: A Top-Down Approach Featuring Internet*, 3/e, Pearson Education, 2005.
2. Peterson L.L. & Davie B.S., *Computer Networks, A systems approach*, 3/E, Harcourt Asia, 2003.
3. Andrew S. Tanenbaum, *Computer Networks*, 3/E, PHI, 1996.
4. IEEE/ACM Trans on Networking

ZZU 301 ENVIRONMENTAL STUDIES

Pre-requisites: NIL

L	T	P	Cr
3	0	0	3

Multidisciplinary nature of environmental studies, Natural Resources, Renewable and non-renewable resources, Forest resources : Use and over-exploitation, deforestation, case studies, Water resources, Mineral resources, case studies. Food resources : World food problems, Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies. Land resources, Role of an individual in conservation of natural resources, Ecosystems, Energy flow in the ecosystem, Biodiversity and its conservation, Inida as a mega-diversity nation, Environmental Pollution, Pollution case studies. Diaster management, Social Issues and the Environment, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies. Wasteland reclamation. Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of pollution) Act Wildlife Protection Act Forest Conservation Act Issues involved in enforcement of environmental legislation. Public awareness. Human Population and the Environment Population growth, variation among nations. Population explosion – Family Welfare Programme. Environment and human health. Human Rights. Value Education. HIV/AIDS. Women and Child Welfare. Role of Information Technology in Environment and human health. Case Studies

References:
1. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
2. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India, Email:mapin@icenet.net (R)
3. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
4. Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
5. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p
6. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
7. Down to Earth, Centre for Science and Environment (R)
8. Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
9. Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R)
10. Heywood, V.H & Waston, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
11. Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.
12. Mckinney, M.L. & School, R.M. 1996. Environmental Science Systems & Solutions, Web enhanced edition. 639p.
13. Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB)
14. Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
15. Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
16. Rao M N. & Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345p.

17. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
18. Survey of the Environment, The Hindu (M)
19. Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science
20. Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II, Enviro Media (R)
21. Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (TB)
22. Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p
    (M) Magazine
    (R) Reference
    (TB) Textbook

CSU 305 THEORY OF COMPUTATION

Pre-requisite: CSU 211 Formal Languages and Automata

L	T	P	Cr
3	0	0	3

Undecidability: Recursive and Recursively enumerable sets, Undecidability, Rice's theorem. Complexity: P, NP, PSPACE and Log space. Reductions and Completeness. Hierarchy theorems, Probabilistic classes, BPP, EXP time and space complexity classes. Logic: Propositional logic, compactness, decidability, Resolution. Undecidability in first order predicate calculus, Resolution. Gödel's incompleteness theorem

Text Books:
1. M. Sipser, *Introduction to the Theory of Computation*, Thomson, 2001.
2. C. H. Papadimitriou., *Computational Complexity*, Addison Wesley, 1994.

References:
1. C. H. Papadimitriou, H. Lewis., *Elements of Theory of Computation*, Prentice Hall, 1981.
2. J. E. Hopcroft and J. D. Ullman, *Introduction to Automata Theory, Languages and Computation*, Narosa, 1989.
3. J. C. Martin, *Introduction to Languages and the Theory of Computation*, Mc Graw Hill, 2002.
4. M. R. Garey and D. S. Johnson. *Computers & Intractability*, W. H. Freeman & Co., San Farnisco, 1979.

CSU 391 NETWORKS LAB

Pre-requisite: Knowledge of Computer Networking concepts

L	T	P	Cr
0	0	3	2

Socket Programming Assignments: - a) To develop a mail user agent   b) UDP based ping client and server.

Implementation of a subset of File Transfer Protocol using TCP/IP b) Implementation of a subset of Simple Mail Transfer Protocol using UDP,   DNS – Tracing the path and find the root/name servers, Implement a reliable transport protocol, To study the operation of IP protocol and datagram format, Using ping, trace route and path MTU programs to study ICMP messages, Link layer protocols:- IEEE 802.3 protocol and Ethernet frame format, Dynamic Host Configuration Protocol – To study about dynamic allocation of IP addresses, Study about the 802.11 frames exchanged between wireless laptop and access point.

References
1. Richard S.W., *Unix Network Programming*, PHI
2. J. F. Kurose and K . W. Ross, *Computer Networking: A Top-Down Approach Featuring Internet*, 3/e, Pearson Education, 2005.
3. Comer D.E., *Internetworking with TCP/IP*, Vol.1, 2 & 3, PHI

44. Campione et. al M., *The Java Tutorial Continued*, Addison Wesley

CSU 392 COMPILER LAB

Pre-requisite: Knowledge of Compiler Design and Implementation

L	T	P	Cr
0	0	5	3

Generation of lexical analyzer using tools such as   LEX. Gene ration of parser using tools such as YACC. Creation of Symbol tables. Semantic Analysis and intermediate code generation. Generation of target code.

References

1. Holub A. I., *Compiler Design in C,* Prentice Hall India

2. Appel A.W., *Modern Compiler Implementation in C,* Cambridge University Press

CSU 321   SOFTWARE ENGINEERING

Pre-requisite: CSU 203 Data Structures & Algorithms

L	T	P	Cr
3	0	0	3

Introduction to Software process , modeling and analysis, software architecture, and software design.

Software Modelling and Analysis, Software Architecture, Software Design.

References:

1. G. Booch, J. Rumbaugh, and I. Jacobson, I. The Unified Modeling Language User Guide. Addison-Wesley, 1999
2. E. Gamma, R. Helm, R. Johnson, and J. Vlissides. Design Patterns: Elements of Reusable Object-Oriented Software. Addison-Wesley, 1995 .
3. F. Buschmann et al. Pattern Oriented Software Architecture, Volume 1: A System of Patterns. John Wiley and Sons, 1996.
4. M. Shaw and D. Garlan. Software Architecture: Perspectives on an Emerging Discipline. Prentice-Hall, 1996

CSU 312 PRINCIPLES OF PROGRAMMING LANGUAGES

Pre-requisite: CSU 203 Data Structures & Algorithms

L	T	P	Cr
3	0	0	3

Imperative Paradigm:

Basic Constructs: Variables, Expressions, Statements. Control constructs: Conditorial and Iterative constructs. Data abstraction. Procedural abstraction.

Functional Paradigm:

Untyped arithmetic expressions: Syntax, Semantics, and evaluations strategies. Untyped lambda calculus: Operational semantics, Programming in the lambda calculus. Typed arithmetic expressions. Simply typed lambda calculus. Extensions to simply typed lambda calculus.

References:

1.Ravi Sethi. Programming Languages: Concepts and Constructs. Addison Wesley 1996.
2.Benjamin C Pierce. Types and Programming Languages, MIT Press, 2002
3.Michael L Scott Programming Language Pragmatics. Elsevier. 2004.

CSU 313 OPERATING SYSTEMS

Pre-requisite: CSU 203 Data Structures & Algorithms

L	T	P	Cr
3	0	0	3

Operating system strategies and resources, processes, threads, Process management, process and resource abstraction, process hierarchy, scheduling mechanisms - various strategies, synchronization, interacting & coordinating processes, semaphores, deadlock - prevention - avoidance - detection and recovery, Memory management - issues - memory allocation - dynamic relocation - various management strategies , Input-Output, File management, storage abstractions, directories and their implementation, protection and security, policy and mechanism, authentication - authorization , Case study of unix kernel and microsoft windows NT (concepts only).

References

1. Silberschatz, Galvin, Gagne, *Operating System Principless*, 7/e, 2006, John Wiley
2. William Stallings, *Operating Systems*, 5/e, Pearson Education
3. Crowley C., *Operating Systems- A Design Oriented Approach*, Tata McGraw Hill, New Delhi
4. Tanenbaum A. S., *Modern Operating Systems*, Prentice Hall, Pearson Education
5. Gary J. Nutt, *Operating Systems - A Modern Perspective*, Addison Wesley

CSU 396 PROGRAMMING LANGUAGES LAB

Pre-requisite: Knowledge of Programming Language concepts

L	T	P	Cr
0	0	3	2

Write an interpreter for lambda-calculus.
Extend the interpreter with Unit type, Let binding, Pairs, Tuples , Records, Sums, Variants, and Lists.

Reference
1.Benjamin C Pierce Types and Programming Languages. MIT Press, 2002.

CSU 397 OPERATING SYSTEMS LAB

Pre-requisite: Knowledge of Operating System concepts

L	T	P	Cr
0	0	5	3

Enhance the primitive NACHOS operating Systems with the following:
Load Module -Implementation of Read(), Write(), Open() and Close() system calls.
Multiprogramming- Implementation of Fork, Wait, Exec and Exit,

Implementation of Translation Look aside Buffer (TLB) in NACHOS.

Build File System in NACHOS.
Implementation of Synchronization mechanisms -Semaphore, Locks and Conditional Variables
Build Networking facilities in NACHOS - Mailbox

References
1. Gary J. Nutt, Operating Systems, Pearson Education, 3/e, 2004.
2. http://www.cs.duke.edu/~narten/110/nachos/main/main.html
3. http://www.ida.liu.se/~TDDB63/material/begguide/beginners-guide.html

CSU 398 MINI PROJECT

Pre-requisite: Knowledge of Software Engineering principles

L	T	P	Cr
0	0	3	1

Each student group (not more than 5 members in a group) is expected to develop a complete software product using software engineering techniques. A detailed report is also to be submitted. The students may be assessed individually and in groups.

CSU 399 INDUSTRIAL TRAINING

Pre-requisite: NIL

L	T	P	Cr
0	0	3	1

Each student is expected to undertake with help from the Department of Training and Placement, Internship in the field of Computer Science and Engineering by undergoing training of at least one-month duration in reputed industries/research centers in the country. The industrial training is expected to be undertaken during the semester recess. The student should write a final report on this training and should make an oral
presentation before an evaluation committee.

SHU 416 ECONOMICS

Pre-requisites: NIL

L	T	P	Cr
3	0	0	3

Definition of economics - nature and scope of economic science - nature and scope of managerial economics, goods - utility - value - wealth - factors of production - land - its peculiarities - labour - its peculiarities and division of labour - capital and capital formation - organisation or enterprise - economies of large and small scale - consumption - wants - its characteristics and classification - law of diminishing marginal utility - relation between economic decision and technical decision - economic efficiency and technical efficiency Demand - demand schedule - demand curve - law of demand - elasticity of demand - types of elasticity - factors determining elasticity - measurement - its significance - supply - supply schedule - supply curve - law of supply - elasticity of supply - time element in the determination of value - market price and normal price - perfect competition - monopoly - monopolistic competition Forms of business - proprietorship - partnership - joint stock company - cooperative organisation - state enterprise - mixed economy - money and banking - nature and functions of money - theory of money - inflation and deflation - banking - kinds - commercial banks - central banking functions - control of credit - monetary policy - credit instrumentInternational trade - distinction between internal and international trade - theory of international trade - free trade v/s protection - balance of trade and balance of payments - exchange control - trade policy of the Government of India - national income - concepts - measurement - difficulties in the measurement its significant - features of underdeveloped economy with special reference to India - taxation - canons of taxation - direct and indirect tax - impact and incidence of the tax - working capital.

References:

1. Dewett K.K. & Varma J.D., *Elementary Economic Theory*, S Chand
2. Barthwal R.R., *Industrial Economics - An Introductory Text Book*, New Age
3. Jhingan M.L., *Micro Economic Theory*, Konark
4. Samuelson P.A., *Economics - An Introductory Analysis*, McGraw Hill
5. Adhikary M., *Managerial Economics*

CSU 401 COMPUTER ARCHITECTURE

Prerequisite: CSU 215 Computer Organization

L	T	P	Cr
3	0	2	4

Performance measurement., *pipelining* - pipeline hazards - data and control hazards. *Instruction level parallelism* - dynamic scheduling –dynamic branch prediction - multiple issue processor – multiple issue with dynamic scheduling-hardware based speculation. *Static scheduling*- VLIW architecture. *Multicore systems. Memory hierarchy design* Multiprocessor and thread level parallelism- cache coherence protocols- Memory consistency-relaxed consistency models, Memory issues in multicore processors Interconnection networks.

References

1. Hennesy J. L. & Pattersen D. A., *Computer Architecture: A Quantitative approach*, 3/e, Harcourt Asia Pte Ltd. (Morgan Kaufman), Singapore
2. Pattersen D. A. & Hennesy J. L., *Computer Organisation and Design: The Hardware/ Software Interface*, 3/e, Harcourt Asia Pte Ltd (Morgan Kaufman), Singapore

CSU 491 SEMINAR

Pre-requisite: NIL

L	T	P	Cr
0	0	3	1

Each student is expected to present a seminar on a topic of current relevance in computer science and engineering – they have to refer papers from standard journals like ACM, IEEE, JPDC, IEE etc. – at least three cross references must be used – the seminar report must not be the reproduction of the original paper.

CSU 498 PROJECT

Pre-requisite: CSU 321 Software Engineering

L	T	P	Cr
0	0	5	3

The project is for a duration of two semesters. Each student group (not more than 5 members in a group) is expected to develop a complete product. The design and development may include hardware and /or software. First part of the project is mainly for the design of the product. An interim report is to be submitted at the end of the semester. The assessment may be made individually and in groups.

MEG 301 PRINCIPLES OF MANAGEMENT

Pre-requisites: NIL

L	T	P	Cr
3	0	0	3

Introduction to management – characteristics – systems approach – task responsibilities and skill required – mission – models in decision making – process of management – planning – organizing – directing – controlling – overview of operations management – human resources management – marketing management – financial management.

Text Books:
1. Koontz & Weihrich, Management, edn., McGraw Hill, 1999.
References:
1. Stoner et-al, Management, edn., Prentice Hall, 1999.
2. Mazda, Engineering Management, Addison Westey, 1999.
3. Certo S., Modern Management, edn., Prentice Hall, 2003.

CSU 363 COMPUTATIONAL INTELLIGENCE

Prerequisite: CSU203 Data Structures & Algorithms

L	T	P	Cr
3	0	0	3

Artificial Intelligence, Structures and Strategies for state space search, Knowledge representation, AI Representational Schemes, Machine Learning, The Genetic algorithm, Genetic Programming, Rule based Expert Systems, Introduction to Natural Language Processing, Languages and Programming Techniques for AI.

1References:
1. Luger G. F., *Artificial Intelligence- Structures and Strategies for Complex Problem Solving*, 4/e, Pearson Education

2. Elain Rich & Kevin Knight, *Artificial Intelligence*, 2/e, Tata McGraw Hill
3. Steven. L. Tanimotto, *The Elements of Artificial Intelligence*, Computer Science Press
4. Winston P H, LISP, Addison Wesley

CSU 499   PROJECT

Pre-requisite: CSU 321 Software Engineering

L	T	P	Cr
0	0	10	5

 This is the second part of the project. This part is for the development, testing, and installation of the product. The product should have user manuals. A detailed report is to be submitted at the end of the semester. The assessment may be made individually and in groups.

PART II : ELECTIVE COURSES

CSU 339 ADVANCED DATA STRUCTURES

Pre-requisite: CSU203 Data Structures and Algorithms

L	T	P	Cr
3	0	0	3

        Review of elementary data structures. Advanced Tree Data Structures, Different types of Heaps and their applications. Hash tables, different implementations, Collision handling, Disjoint set representation – Path compression algorithm – Elementary Graph algorithms. Bellman-Ford Algorithm, Floyd-Warshall algorithm, Johnson's algorithm for sparse graphs. Flow Networks. Data structure choice and justification for some practical applications.

References:
1. Cormen T.H., Leiserson C.E, and Rivest R.L., *Introduction to Algorithms*, Prentice Hall India, New Delhi, 1990.
2. Wirth N., Algorithms + Data Structures = Programs, Prentice Hall India, New Delhi, 1976.
3. Sartaj Sahni, Data Structures, Algorithms and Applications in C++, Universities Press, 2005.

CSU 358 COMMUNICATION AND INFORMATION THEORY

Pre-requisites: CSU 201 Discrete Computational Structures / MAG 501 Discrete Mathematics,
Knowledge of Probability Theory

L	T	P	Cr
3	0	0	3

Entropy – Source Coding theorem – Shannon-Fano, Huffman Coding and its. Optimality, Channel Models – BSC – Information – Channel Coding theorem. Channel relationships, Error Correcting Codes – Maximum Likelihood

decoding. Single Error Correction and Double Error Correction, Associated decoding. Linear Codes – Bounds - Encoding and Decoding.

Text Book:
 T. Cover and J. Thomas, Elements of Information Theory, Wiley, 1991.

CSU 371 LOGIC FOR COMPUTER SCIENCE

Pre-requisite: CSU305 Theory of Computation

L	T	P	Cr
3	0	0	3

Propositional logic, Syntax and Semantics, Soundness , Completeness, Predicate logic, Syntax and Semantics, Soundness , Completeness, Linear time Temporal Logic(LTL), Syntax and Semantics, Buchi Automata, Automata theortic methods, Satisfiability, Model checkingVeification, Tools used for verification.

References:
1. Jerome Keisler H. Joel Robbin, *Mathematical Logic and Computability,* McGraw-Hill International Editions, 1996.
2. Papadimitriou, C. H., *Computational Complexity,* Addison Wesley, 1994
3. Gallier, J. H., Logic for Computer Science: Foundations of Automatic Theorem Proving, Harper and Row, 1986

CSU 331 COMPUTER GRAPHICS AND MULTIMEDIA

Pre-requisite: CSU203 Data Structures & Algorithms

L	T	P	Cr
3	0	0	3

Basic raster graphics algorithms for drawing 2D primitives - 2D transformations - Input devices and interactive techniques - 3D graphics - 3D transformations. Introduction to multimedia - multimedia hardware - multimedia software. Multimedia building blocks - audio - images and graphics - animation techniques. Data compression - basic compression techniques like JPEG, H.261, MPEG and DVI - multimedia database systems.

References
1. Foley J. D., Van Dam A., Feiner S. K., & Hughes J. F., *Computer Graphics Principles and Practice*, Second Edition, Addison Wesley
2.   Ralf Steinmetz & Klara Nahrstedt, *Multimedia: Computing, Communications and Applications*, Pearson Education
3. Newmann W & Sproull R.F., *Principles of Interactive Computer Graphics*, McGraw-Hill

CSU 341 DISTRIBUTED COMPUTING

Prerequisite: CSU313 Operating Systems

L	T	P	Cr
3	0	0	3

 Models of distributed systems, Happened Before and Potential Causality Model, Models based on States. Logical clocks, Vector clocks, Verifying clock algorithms, Direct dependency clocks, Distributed Mutual exclusion algorithms. Mutual exclusion algorithms using tokens and Quorums, Drinking philosophers problem, Dining philosophers problem Leader election algorithms. Global state detection, Global snapshot algorithm, Termination detection, Causal message ordering algorithms, Self stabilization, Mutual exclusion with K-state machines.

References:
1.   Vijay K. Garg., Elements of Distributed Computing, Wiley & Sons, 2002
2. Chow R. & Johnson T., *Distributed Operating Systems and Algorithms*, Addison Wesley, 2002
3. Tanenbaum S., *Distributed Operating Systems*, Pearson Education.,2005
4. Coulouris G., Dollimore J. & Kindberg T., *Distributed Systems Concepts And Design*, 2/e, Addison Wesley 2004

CSU 343 EMBEDDED SYSTEM DESIGN

Pre-requisite: CSU 313 Operating Systems
CSU 202 Logic Design
CSU 321 Software Engineering

L	T	P	Cr
3	0	0	3

Embedded system overview, trends in embedded software development, applications of embedded systems, hardware architecture, software engineering practices in the embedded software development process, embedded software development environments, embedded OS, development tools for target processors, real-time embedded software, embedded communication, mobile and database applications.

References:

1. R. Kamal, *Embedded Systems: Architecture, Programming & Design*, Tata McGraw Hill, 2003.

2. F. Vahid & T. Givargis *Embedded System Design: A Unified Hardware/Software Introduction*,

   John Wiley.

3. DreamTech Software Team, *Programming of Embedded Systems*, Wiley DreamTech, 2002.

CSU 353 MOBILE COMMUNICATION SYSTEMS

Prerequisite: CSU 304 Computer Networks

L	T	P	Cr
3	0	0	3

Introduction, wireless transmission, multiplexing, modulation, cellular systems, CSMA collision avoidance, polling, CDMA, mobile services, system architecture, protocols, localization and calling, satellite systems, WDM Optical networks, Wireless LAN, infrastructure and adhoc networks, - IEEE 802.11 b/a/g, Mobile network layer,dynamic host configuration protocol, Adhoc networks, routing, mobile transport layer, WAP, WML, wireless telephony application.

References
1. Schiller J., *Mobile Communications*, 2/e, Pearson Education, 2003.
2. C. Siva Ram Murthy, *Ad Hoc Wireless Networks: Architectures and Protocols*, Pearson Education, 2004.

CSU 315 COMPUTER HARDWARE

Prerequisite: CSU 202 Logic Design

L	T	P	Cr
3	0	0	3

PC hardware: motherboard, memory SDRAM, RDRAM. Controllers, *8086/8088 Hardware specification*, Features of Pentium IV processor, *Microprocessor architecture*: real mode and protected mode memory addressing, *Addressing 80X86 instructions, Programming the microprocessor*. Memory interface. I/O interface: port address decoding, PPI, 8279 interface, 8254 timer interface, 16550 UART interface, ADC/DAC interfaces. Interrupts: interrupt processing, hardware interrupts, expanding the interrupt, 8259A programmable interrupt controller. DMA: DMA operation, 8237 DMA controller, shared bus operation, disk memory systems, video displays. Bus interface: ISA bus, EISA and VESA buses, PCI bus.

References:

1. B. B. Brey*, The Intel Microprocessors 8086 to Pentium: Architecture, Programming and Interface*, 6/e,
   Prentice Hall of India, New Delhi, 2003.
2. Programming for embedded systems Dream Software team , Willey 2002
3. H. P. Messmer, *The Indispensable PC Hardware Book*, 3/e, Addison Wesley, 1997.
4. A. K. Ray, and K. M. Bhurchandi, Advanced Microprocessors and Peripherals, Tata McGraw Hill, 2000.
5. D. V. Hall, *Microprocessors and Interfacing: Programming and Hardware*, 2/e, Tata McGraw Hill,
   New Delhi, 1992.
6. K. Miller, *An Assembly Language Introduction to Computer Architecture using the Intel Pentium*,
Oxford University Press, 1999.

7. S. J. Bigelow, *Troubleshooting, Maintaining, and Repairing PCs*, 2/e, Tata McGraw Hill, New Delhi, 1999.

CSU 333 OBJECT ORIENTED ANALYSIS AND DESIGN

Pre-requisite: CSU 203 Data Structures and Algorithms

L	T	P	Cr
3	0	0	3

Introduction to Object-Oriented paradigm – Object Oriented analysis -Object-oriented Modeling Concepts - Unified Modeling Language – Types of models - Design Patterns – Object Oriented Testing Methodologies.

References:
1. Erich Gamma, Richard Helm, Ralph Johnson, John M.Vlissides, Design Patterns: Elements of Reusable Object-Oriented Software, Addison-Wesley Professional Computing Series, 1995.
2. James O.Coplien, Advanced C++ Programming Styles and Idioms, Addison Wesley, 1991.

3. Peter Coad and Edward Yourdon, Object-Oriented Analysis, Prentice Hall, 1990.

4. Margaret A. Ellis, Bjarne Stroustrup, Annotated C++: Reference Manual, Addison-Wesley Professional, 1990.

5. Booch G. Rumbaugh J & Jacobsons I, The Unified Modeling Language user guide, Addison Wesley. 1999.

6. Bahrami A, Object Oriented System Development, Mc Graw Hill, 1998.

CSU 334 WEB PROGRAMMING

Pre-requisite: CSU 304 Computer Networks

L	T	P	Cr
3	0	0	3

Internet and WWW, HTML, Paintshop, Photoshop, FrontPage, JavaScript/Jscript, Dynamic HTML, multimedia, e-commerce security, web servers, SQL, ADO and RDS, Active server pages, CGI and Perl, XML, Servlets .

1Text Book:
1. H. M. Deitel, P. J. Deitel and T. R. Nieto, *Internet and World Wide Web: How To Program*, Pearson Education, 2000

CSU 431 ADVANCED DATABASE MANAGEMENT SYSTEMS

Pre-requisite: CSU213 Database Management Systems

L	T	P	Cr
3	0	0	3

Overview of relational database concept - object oriented database - overview of CORBA standard for distributed objects, Distributed database concepts - overview of client - server architecture and its relationship to distributed database, Deductive database - basic inference mechanism for logic programs - data warehousing and data mining - database on World Wide Web - multimedia database - mobile database - geographic information system - digital libraries, Oracle and microsoft access - basic structure of the oracle system, database structures and its manipulation

in oracle - programming oracle applications - oracle tools - an overview of microsoft access features and functionality of access - distributed databases in oracle.

References:

1. Elmasri, Navathe, Somayajulu, Gupta, *Fundamentals of Database Systems*, Pearson Education, 2006.

2. Ramakrishnan R. & Gehrke J *Database Management Systems*, 3rd Edition., McGraw Hill.

3. Connolly and Begg, Database systems, 3rd Edition, Pearson Education, 2003

4. O'neil P. & O'neil E *Database Principles, Programming and Performance*, 2nd Edition., Harcourt Asia (Morgan Kaufman).

5. Silberschatz, Korth H. F. & Sudarshan S, *Database System Concepts*, Tata McGraw Hill.

CSU 441 ADVANCED COMPUTER ARCHITECTURE

Pre-requisite: CSU215 Computer Organization

L	T	P	Cr
3	0	0	3

Parallel Computation, Performance, Shared Memory Multiprocessors, Memory Consistencey models scalability, Interconnection network design, Latency tolerance techniques, Superscalar Design, Classical papers in Computer architecture, quantum architecture, Processor based Security.

References:

1. Culler D and Singh J. P., *Parallel Computer Architecture: A Hardware Software Approach*, Harcourt Asia Pte Ltd, Singapore, 1999.
2. Hill M, Jouppi N and Sohi G, *Readings in Computer Architecture,* Morgan Kauffman, 2000.
3. Shen J. P. and Lipasti M.,, *Modern Processor Design*: Fundamentals of Superscalar Processors, McGraw Hill, First edition, 2000.

CSU 352 CODING THEORY

Pre-requisite: CSU 201 Discrete Computational Structures

L	T	P	Cr
3	0	0	3

Linear codes and syndrome decoding. Hamming codes. Cyclic codes – BCH, RS codes – Polynomial time decoding. Shift register encoders for cyclic codes. Cyclic hamming codes, Convolutional codes – Viterbi decoding. State diagram, trellises. Path enumerators and error bounds, Expander Codes – linear time decoding. Basic expander based construction of list decodable codes.

Text Book:
R.J. McEliece, The Theory of Information and Coding, Addison Wesley, 1997.

CSU 354   ELECTRONIC COMMERCE

Prerequisite: CSU 302 Number Theory & Cryptography

L	T	P	Cr
3	0	0	3

Web commerce concepts – the e-commerce phenomenon - electronic marketplace technologies - web based tools for e-commerce - e-commerce softwares - hosting services and packages, approaches to safe e-commerce - PKI-biometrics for security in e-commerce – smart cards and applications, payment agents – mobile agent based systems – digital cash – security requirements for digital cash - Digital cheques, netcheque systems, Secure electronic transaction- secure online payment – micropayments challenges and opportunities of e-payment.

References:
1. Weidong Kou, *Payment Technologies for E-Commerce*, Springer, 2003.
2. Kalakota R. & Whinston A.B., *"Frontiers of Electronic Commerce*", Addison-Wesley, New Delhi
3. Janice Raynolds, The Complete E-Commerce Book, 2/e, CMP Books, 2004.

CSU 356   MOBILE COMPUTING

Prerequisite: CSU304 Computer Networks

L	T	P	Cr
3	0	0	3

Introduction to mobile computing, introduction to XML and UML.Device independent and multichannel user interface development using UML, developing mobile GUIs, VUIs and mobile applications, multichannel and multimodal user interfaces. Mobile agents and peer-to-peer architectures for mobile applications, wireless connectivity, mobility and location based services, active transactions. Mobile Security, the mobile development process, architecture design and technology selection, testing mobile applications.

References:
1. Reza B'Far, Mobile Computing Principles, Cambridge University Press, 2005.
2. U. Hansmann, L. Merk, M. S. Nicklous and T. Stober, *Principles of Mobile Computing*, 2/e, Springer, 2003.

CSU 361 IMAGE PROCESSING

Pre-requisite: CSU 201 Discrete Computational Structures / MEG 501 Discrete Mathematics

L	T	P	Cr
3	0	0	3

Digital image representation, fundamental steps in image processing, elements of visual perception, sampling and quantization, basic relationship between pixels, image transforms - Introduction to Fourier transform - discrete Fourier transform - some properties of 2-fourier transform (DFT) - the FFT, Image enhancement - point processing - spatial filtering - frequency domain - color image processing - image restoration - degradation model , Image compression, image compression models - elements of information theory - error-free compression, image compression standards, Image reconstruction from projections - basics of projection - parallel beam and fan beam projection - method of generating projections - Fourier slice theorem - filtered back projection algorithms - testing back projection algorithms.

References

1. Rafael C., Gonzalez & Richard E. Woods, *Digital Image Processing*, Addison Wesley, New Delhi
2. Rosenfeld A. & Kak A.C., *Digital Picture Processing*, Academic Press
3. Jain A.K, Fundamentals of *Digital Image Processing*, Prentice Hall, Englewood Cliffs, N.J.
4. Schalkoff R. J., *Digital Image Processing and Computer Vision*, John Wiley and Sons, New York
5. Pratt W.K., *Digital Image Processing*, 2nd edition, John Wiley and Sons, New York

CSU 362 PATTERN RECOGNITION

Pre-requisite: CSU 203 Data Structures and Algorithms

L	T	P	Cr
3	0	0	3

Introduction- Introduction to statistical, syntactic and descriptive approaches. Parameter estimation and supervised learning, Nonparametric technic- density estimation, parzen windows, k-nearest Neighbour estimation, Linear discriminant functions, Syntactic approach to PR- Introduction to pattern grammars and languages.

References

1. Duda & Hart P.E, *Pattern Classification And Scene Analysis*, John Wiley and Sons, NY
2. Gonzalez R.C. & Thomson M.G., *Syntactic Pattern Recognition - An Introduction*, Addison Wesley
3. Fu K.S., *Syntactic Pattern Recognition And Applications*, Prentice Hall, Englewood cliffs, N.J.

CSU 411 COMPUTER SECURITY

Pre-requisites: CSU 304 Computer Networks, CSU 313 Operating Systems
CSU 213 Database Management Systems

L	T	P	Cr
3	0	0	3

Concepts of Security, Confidentiality, Integrity, Authenticity, Availability, Reliability, Concepts of Computationally Secure and Information theoretic security, Access Control Matrix and Mechanisms, Vulnerability Analysis and Auditing, Systems Security – Operating Systems and Database Security.
Network Security. Firewalls, IDS. Program Security. Security features of a programming language.

References:
1. Introduction to Computer Security. Matt Bishop. Addison-Wesley. 2004.
2. Security in Computing. Charles P Pfleeger. Pearson Education India. 2003.

CSU 364 NATURAL LANGUAGE PROCESSING

Pre-requisite: CSU 203 Data Structures and Algorithms

L	T	P	Cr
3	0	0	3

Introduction to Natural Language Understanding, Different levels of Language Analysis, Representations and Understanding, Linguistic Background, Grammars and Parsing, Top-Down and Bottom-Up Parsers, Transition Network Grammars, Feature Systems and Augmented Grammars, Morphological Analysis and the Lexicon, Parsing with Features, Augmented Transition Networks, Grammars for Natural Language, Movement Phenomenon in Language, Hold mechanisms in ATNs, Human preferences in Parsing, Encoding uncertainty, Ambiguity Resolution: Statistical Methods, Part-of-Speech tagging, Probabilistic Context-Free Grammars, Best First Parsing.

References:
1. James Allen, *Natural Language Understanding*, Second Edition, 2003, Pearson Education.
2. D Juraffsky, J H Martin, *Speech and Language Processing*, Pearson Education

CSU 373 COMPUTATIONAL COMPLEXITY

Pre-requisite: CSU 305 Theory of Computation

L	T	P	Cr
3	0	0	3

Review of Complexity Classes, NP and NP Completeness, Randomized Computation, PTMs, Examples, Important BPP Results, Permanent's and Valiant's Theorem, Interactive Proofs, Lowerbounds: Randomized Decision Trees, Levin's theory, Polynomial time samplability, expander graphs, derandomization, Error Correcting Codes, PCP and Hardness of Approximation, Quantum Computation

References:
1. Papadimtriou C. H.., *Computational Complexity*, Addison Wesley, First Edition, 1993.
2.` Motwani R*, Randomized Algorithms*, Cambridge University Press, 1995.
3. Vazirani V., *Approximation Algorithms*, Springer, First Edition, 2004.
4. Mitzenmacher M and Upfal E., *Probability and Computing, Randomized Algorithms and Probabilistic Analysis*, Cambridge   University Press, 2005.
5. Arora S and Boaz B, *Computational Complexity*, (Web Draft) http://www.princeton.edu/theory/complexity

CSU 471 ADVANCED TOPICS IN ALGORITHMS

Pre-requisite: CSU 301 Design and Analysis of Algorithms

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L	T	P	Cr
3	0	0	3

Discrete Probability: Probability, Expectations, Tail Bounds, Chernoff Bound, Markov Chains, Randomized Algorithms, Moments and Deviations. Tail Inequalities. Randomized selection, Las Vegas Algorithms. Monte Carlo Algorithms. De-Randomization, Complexity: Probabilistic Complexity Classes, Proof Theory. Interactive Proof Systems, Complexity analysis of probabilistic algorithms . The complexity classes PP and BPP, Kolmogorv Complexity – basic concepts.

References:
1. R. Motwani and P. Raghavan, Randomized Algorithms, Cambrdige University Press, 1995
2. C. H. Papadimitriou, Computational Complexity, Addison Wesley, 1994
3. Dexter C. Kozen, The Design and Analysis of Algorithms, Springer verlag N.Y, 1992

CSU 472 QUANTUM COMPUTATION

Pre-requisites: CSU 203 Data Structures and Algorithms, CSU 301 Design and Analysis of Algorithms

L	T	P	Cr
3	0	0	3

Review of Theory of Finite Dimensional Hilbert Spaces and Tensor Products, Models for Quantum Computation Quantum Algorithms – Grover's and Shor's Algorithms. Quantum Complexity Classes , Introduction to Quantum Coding Theory.

Reference:
Gruska, J. Quantum Computing, McGraw Hill, 1999.