

**B.Tech (Information Technology)**

Semester	1	2	3	4	5	6	7	8	Discipline /NSS		CH	IC	PC	PE	OE	Total
I & II									1			45				45
III	IT-221 Discrete Structures (3-1-0) 4	IT-223 Data Structures and Algorithms (3-0-0) 3	IT-225 Formal Languages and Automata Theory (3-0-0) 3	IT-251 Data Structure and Algorithm Lab (0-0-3) 2	EC-251 Electronics Devices and Circuits (3-0-2) 4	EC-253 Switching Theory & Finite Automata (3-0-0) 3	Open Elective I 4			23			19	4		23
IV	HS-200 Social Science and Economics 2	IT-222 Data Base Modelling and Administration (4-0-0) 4	IT-226 Operating System (3-0-0) 3	IT-228 Computer Architecture (3-0-0) 3	IT-250 DBMS Lab (0-1-3) 3	IT-252 OS Lab (0-0-3) 2	Open Elective II 4	Creative Arts/ Sports/ NSS/ Hindi 1	Discipline 1	23	4	15		4		23
V	IT-321 Information System Security (3-0-0) 3	IT-323 E-Commerce and Web Applications (3-0-0) 3	IT-325 Computer Network & Administration (3-0-0) 3	IT-351 Information System Security Lab (0-0-3) 2	IT-353 Web based Development Lab (0-0-3) 2	IT-355 Network Programming & Administration Lab (0-0-3) 2	Program Elective I 4	Open Elective III 4		23			15	4	4	23
VI	IT-322 Software Engg. (3-0-0) 3	IT-324 Compiler Design (3-0-0) 3	IT-350 Compiler Lab (0-0-3) 2	IT-352 Free and Open Source Lab (0-0-3) 2	IT-354 Seminar (0-3-0) 3	Program Elective II 4	Open Elective IV 4		Discipline 1	22	1	13	4	4		22
VII	IT-451 Industrial Training (0-3-0) 3	Program Elective III 4	Program Elective IV 4	Program Elective V 4	IT-453 Design Elective 6	Open Elective V 4				25			3	18	4	25
VIII	IT-452 Project 10	Program Elective VI 4	Program Elective VII 4						Discipline 1	19	1	10	8	0		19
Total Credi											180	<b>51</b>	<b>75</b>	<b>34</b>	<b>20</b>	<b>180</b>

**Program Elective I**

IT-371 Programming in Java  
 IT-373 Python Programming  
 IT-375 Scripting Language  
 IT-377 Management Information Systems

**Program Elective II**

IT-370 Signals and Systems  
 IT-372 Object Oriented System Design  
 IT-374 Multimedia Technology  
 IT-376 Artificial Intelligence

**Program Elective III**

IT-471 Computer Graphics  
 IT-473 Human Computer Interaction  
 IT-475 GUI Programming  
 IT-477 Selected Topics in OS  
 IT-479 Mobile and Wireless Computing

**Program Elective IV**

IT-481 Advanced Compiler  
 IT-483 Design and Analysis of Algorithm  
 IT-485 Semantic Web  
 IT-487 Data Mining and Data Warehousing  
 IT-489 Implementation of Data Bases

**Program Elective V**

IT-491 Information Retrieval  
 IT-493 Wireless Sensor Networks  
 IT-495 Topics in High Speed Networking  
 IT-497 Digital Watermarking and Steganography  
 IT-499 Software Project Management

**Program Elective VI**

IT-470 Digital Forensics  
 IT-472 Biometric Security  
 IT-474 VLSI Algorithms  
 IT-476 Intrusion Detection  
 IT-478 Pattern Recognition

**Program Elective VII**

IT-480 Multi-Core Architectures  
 IT-482 Software Testing  
 IT-484 Distributed Systems  
 IT-486 Advanced Topics in Data Bases  
 IT-488 Expert Systems

## B.Tech Information Technology Semester III

### IT-221 Discrete Structures

(3-0-0)

3

**Logic:** Introduction to Logic, Propositional Logic and Predicate Logic

**Propositional Logic:** Elements of Propositional Logic, Truth Table, Connectives, Construction of Proposition, Converse and Contrapositive, Reasoning with Propositions, Identities of Propositions and Dual, Use of Identities, Implications, Reasoning with Propositions, Proof of Identities, Proof of Implications.

**Predicate Logic:** Well Formed Formula (Wff) of Predicate Logic, Predicate, Quantification, Constructing Formulas, Reasoning with Predicate Logic, Quantifiers and Connectives.

**Set and Functions:** Sets, relations, functions, operations, and equivalence Relations, relation of partial order, partitions, binary relations, Equivalence relations. Recursion, Proof by Induction

**Number-theoretic algorithms:** Greatest Common Divisor, Chinese Remainder Theorem, Primality testing, polynomial representation of binary number, Galois fields, primitive roots, discrete logarithms.

#### Text/ References:

1. Kolman B., Busby R: *Discrete Mathematical Structures for Compute Science*, PHI.
2. Liu: *Introduction to Discrete Mathematics*, McGraw-Hill.
3. Graham, Knuth, Pratshnik : *Concrete Mathematics*.
4. Grimaldi: *Discrete Mathematical Structures*.
5. Grossman P, *Discrete Mathematics for Computing*, Macmillan 1995
6. Ross KA & Wright CRB, *Discrete Mathematics*, Prentice-Hall 1999
7. Johnsonbaugh R, *Discrete Mathematics*, Macmillan.
8. Wiitala, *Discrete Mathematics*, McGraw Hill.
9. Biggs N L, *Discrete Mathematics*, Oxford.
10. Truss J, *Discrete Mathematics for Computer Scientists*, Addison Wesley.

### IT-223 Data Structures and Algorithms

(3-0-0)

3

Introduction to data structures, dynamic aspects of operations on data, analysis of algorithms. Creation and manipulation of data structures: arrays, lists, stacks, queues, trees, graphs, heaps, hashing and hash tables, height balanced trees, tries.

Algorithms and data structures for sorting and searching, merging, graph traversals, shortest path and minimum spanning tree, order statistics, data structures for images, greedy algorithms, dynamic programming, algorithms- data structures dependency, introduction to complexity analysis and measures. Special topics from problems in computational geometry and string matching

#### Text/ References:

1. Kruse R.L., *Data Structure and Program Design*, PHI.
2. Rivest, Cormen, *Introduction to Algorithms*, MIT Press
3. Horowitz and Sahni: *Data Structure in C++*, Glagotia
4. Ellis Horowitz, Sartaj Sahni, *Fundamentals of Data Structures*
5. Aaron M. Tenenbaum, Y. Langsam, Moshe J. Augenstein, *Data Structures Using C*

### IT-225 Formal Languages and Automata Theory

(3-0-0)

3

Introduction to formal languages and their operations, abstract machines.

Finite automata and regular expressions, Non-deterministic finite automata, Mealy and Moore machines, minimization of finite automata, Pumping lemma for regular languages.

Chomsky classification of languages, regular grammars, context free grammars, simplification of context

free grammars, Normal forms of context free grammars.

Push Down Automata Theory: Push down automata and context free languages, Pumping lemma for context free languages.

Turing hypothesis, Turing machine, Minsky's theorem, TM variation and encoding, computability and acceptability.

**Text/ References:**

1. Hopcroft, Motwani and Ullman: *Introduction to Automata Theory, Languages and Computation*, Pearson Education.
2. Cohen: *Introduction to Computer Theory*, Addison Wesley.
3. Martin: *Introduction to Languages and Theory of Computation*, TMH.

**IT-251 Data Structure and Algorithm Lab**

**(0-0-3)**

**2**

The following proposed coverage are broad guiding areas in lab. The instructor offering the course in consultation with the theory offered can adopt further variations in tune with IT-223.

1. Implementation of experiments with, basic data structures and use in dynamic operations on data for different algorithms and problem domains;
2. Analysis of basic sorting and searching algorithms and their relationship to these data structures. Comparison of asymptotic complexity with real behaviour of algorithms;
3. Sorting programs: Bubble sort, Merge sort, Insertion sort, Selection sort, and Quick sort.
4. Searching programs: Linear Search, Binary Search.
5. Array implementation of Stack, Queue, Circular Queue, Linked List.
6. Implementation of Stack, Queue, Circular Queue, Linked List using dynamic memory allocation.
7. Implementation of Binary tree.
8. Program for Tree Traversals (preorder, inorder, postorder).
9. Program for graph traversal (BFS, DFS).
10. Program for minimum cost spanning tree, shortest path.

**Text/ References:**

1. Kruse R.L., Data Structure and Program Design, PHI.
2. Rivest, Cormen, Introduction to Algorithms, MIT Press
3. Horowitz and Sahni: Data Structure in C++ , Glagotia
4. Ellis Horowitz, Sartaj Sahni, Fundamentals of Data Structures
5. Aaron M. Tenenbaum, Y. Langsam, Moshe J. Augenstein, Data Structures Using C

**EC-251 Electronics Devices and Circuits**

**(3-0-2)**

**4**

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As offered by the ECE Department.

**EC-253 Switching Theory & Finite Automata**

**(3-0-0)**

**3**

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As offered by the ECE Department.

**Open Elective I**

**(X-X-X)**

**3/4**

Please refer to concerned Department.

## B.Tech Information Technology Semester IV

### HF-201 Humanities and Social Sciences

(X-X-X)

2

Please refer to Humanities and Social Sciences Department.

### IT-222 Data Base Modelling and Administration

(4-0-0)

4

Design: Conceptual design, three tier architecture, ER Diagram – entity (strong and weak), Data aggregation, specialization, generalization.

Data models: Relational, Network, Hierarchical and Object Oriented.

Normalization: Constraints – integrity and domain, Primary key, Super key, foreign key, Alternate key, candidate key, normal forms 1NF, 2NF, 3NF, BCNF, 4NF.

SQL: DDL and DML, Relational Algebra, SQL Queries, Triggers and views, Constraints assertions.

Data Organization: Sequential, indexed random and hashed files. Inverted and multilist structures, B trees, B+ trees, Query Optimization, Join Algorithm, Statistics and Cost Base optimization.

DBMS internals: Transaction Processing, concurrency control, and recovery management. Transaction model properties and state serialisability , Lock base protocols, two phase locking.

#### Text/References:

1. Almasri and S.B. Navathe: *Fundamentals of Database Systems*, Addison Wesley.
2. Kevine Kline, SQL in Nutshell, O'Reilly & Associates.
3. Raghu Ramakrishnan, Johannes Gehrke Database Management Systems, McGraw Hill.
4. H.F. Korth, Silberschatz, Sudarshan: *Database Systems Concepts*, McGraw Hill
5. C.J. Date: *Data Base Design*, Addison Wesley
6. Hansen and Hansen : *DBM and Design*, PHI

### IT-224 Operating System

(3-0-0)

3

Operating System Overview: Operating Systems objectives & functions, the evolution of operating Systems, Major Achievements, Examples of Operating systems. Process Description & Control: Process states, Process Description, Process Control, and Processes & Threads. Concurrency: Mutual Exclusion & Synchronization Principles of Concurrency, Mutual Exclusion-Software Approaches. Graphical User Interface & OS: Introduction, Windowing Technology, GUI, Relationship between the OS & Windows, Components of GUI, and Requirement of a Windows based GUI, MS-WINDOWS & NT, and Windows 2000. Introduction to UNIX Operating system.

#### Text/References:

1. Modern Operating Systems by Tanenbaum (PHI)
2. Operating System Concepts- Abraham Silberchatz, Peter B. Galvin, Greg Gagne 7th Edition, John Wiley.
3. Systems Programming & Operating Systems (Second Edition) by Dhamdhare (TMH)

### IT-226 Computer Architecture

(3-0-0)

3

**Introduction to computer architecture and organization:** Digital components, Von Neumann Machine Architecture, Flynn Classification

**Register Transfer Language:** Micro operations - data transfer operations, arithmetic, logic and shift micro operations and their hardware implementations as a simple Arithmetic and logic unit.

**CPU Organization:** Addressing techniques - Immediate, direct, indirect, register, register indirect, index, relative and stack addressing techniques.

**Instruction formats:** Instruction set design, Instruction types: example for zero address, one address, two address and three address machines, Stack, accumulator and general purpose register organization

**Arithmetic Algorithms:** Arithmetic and Logic Unit, Adders - Full adder, Ripple carry adder, Carry look ahead adder, Carry select adder, carry save adder, Multiplication - Add and Shift method, Booth's Multiplier, m Array Multiplier, Division - Restoring and Non restoring method.

**Pipelining:** Pipeline structure, pipeline performance measures, Pipeline types - Instruction and Arithmetic pipelines.

**Memory Organization:** Memory device characteristics, RAM organization: 1D and 2D organization, Virtual memory - Paging and Segmentation, High speed memories: Associative and Cache memory Control Unit Design, Hardwired and Micro programmed control unit design implementation techniques

**Input-Output Design:** IO interface, Bus structure, Modes of data transfer, Interrupts, Input Output Processor, Serial Communication

**Text/References:**

1. Computer Architecture: A Quantitative Approach, J.L. Hennessy and D.A. Patterson, 4<sup>th</sup> Edition Elsevier.

**IT-252 DBMS Lab**

**(0-0-3)**

**2**

The following proposed coverage are broad guiding areas lab. The instructor offering the course in consultation with the theory offered can adopt further variations in tune with IT-222.

1. Conceptual designs using ER diagrams.
2. Design of databases. Based on templates, files and relational basis.
3. Development and implementation of DB system from the fundamentals.
4. Experiments on SQL queries.

**IT-254 OS Lab**

**(0-0-3)**

**2**

The following proposed coverage are broad guiding areas in lab. The instructor offering the course in consultation with the theory offered can adopt further variations in tune with IT-224.

1. Write shell scripts for (i) multiplication table generation, (ii) copying multiple files to a directory, (iii) counting the number of lines and words present in a given file, (iv) displays the list of all the files in a given directory.
2. Write a shell script to implement small calculator – addition, subtraction, multiplication and division of two integers. Division has two options: one returns the quotient and the other returns remainder.
3. Write a shell script to reverse the rows and column of a matrix.
4. Write a C program to implement CPU Scheduling.
5. Write a C program to page replacement algorithms.
6. Write a C program to implement virtual memory.
7. Write a C program using fork() to illustrate process management.
8. Write a C program to implement concurrent programming constructs through semaphores – dining philosophers' problem, consumer-producer, readers-writers etc.
9. Write a C program that illustrate how to execute two commands concurrently with a command pipe.
10. Write a C program to implement deadlock avoidance algorithms.

**Text/References:**

1. Unix concepts and applications by Sumitbha Das, TMH applications.
2. Unix Programming by Stevens, Pearsons Education.
3. Shell Programming by Yashwant Kanetkar.

4. Operating System concepts by silberschatz, and Peter Galvin.

**Open Elective II**

(X-X-X)

3/4

Please refer to concerned Department.

**B.Tech Information Technology Semester V**

**IT-321 Information System Security**

(3-0-0)

3

**Review of Number theory:** Prime numbers, modular arithmetic, Fermat's theorem, Euler's theorem, Chinese remainder theorem, Discrete logarithms, Random number, prime number, factoring, .

**Cryptography:** Classical, stream and block cipher, steganography. Public v/s private key cryptography.

**Random Number Generation:** Pseudo Random Number, PRNG, LFSR, Blum-Blum Shub generator

**Private-key cryptography:** Feistel structure, DES, design of S-boxes, AES, Triple DES.

**Public key cryptography:** Key management, Key exchange – Diffie-Hellman, El-Gamal, Merkle's Puzzle, Authentication, Signatures, Deniability, RSA.

**Threshold Cryptography:** Sharing Secrets.

**Digital Signature:** DSA and its variants, discrete logarithm based digital signatures.

**One-way hash functions** – MD5, SHA (Secure Hash Algorithm).

**Cryptanalysis:** Differential and linear cryptanalysis - cracking DES.

**Text & References:**

1. Stallings, Cryptography and Network Security: Principles and Practice, Pearson Education Asia. ISBN 981-403-589-0.
2. B Schneier, Applied Cryptography, Wiley. ISBN 0-471-11709-9
3. D Kahn. The Codebreakers, Sphere books. ISBN 0-7221-51497
4. P Wayner, Disappearing Cryptography, Academic Press. ISBN 0-12-738671-8
5. Cracking DES, Electronic Frontier Foundation. ISBN 1-56592-520-3
6. A.J. Menezes, P.C. van Oorschot and S.A. Vanstone, Applied Cryptography, CRC Press, ISBN 0-8493-8523-7, 1997
7. D.R. Stinson, Cryptography - Theory and practice, CRC Press, ISBN 0-8493-8521-0, 1995

**IT-323 E-Commerce and Web Applications**

(3-0-0)

3

Electronic commerce environment and opportunities: Back ground – The Electronic commerce Environment – Electronic Market Place Technologies. Modes of electronic commerce: Overview – EDI – Migration to open EDI – E commerce with WWW/Internet – Commerce Net Advocacy – Web commerce going forward. Approaches to safe electronic Commerce – Overview – Source – Transport Protocols – Secure Transactions – Secure Electronic Payment Protocol – Secure Electronic Transaction – Certificates for Authentication – Security on Web Servers and enterprise networks. Electronic cash and electronic payment schemes – Internet Monetary Payment and Security requirements – payment and purchase order process – online electronic cash. Master card/ Visa Secure electronic transaction: Introduction – Business requirements - Concepts - Payment Processing. Email and Secure Email Technologies for Electronic Commerce: Introduction – The means of Distribution – A model for Message Handling – How Does a Email Work. Internet Resources for Commerce: Introduction – Technologies for Web Servers – Internet Applications for commerce – Internet Charges – Internet Access and Architecture – Searching the Internet.

**Text/ References:**

1. Web Commerce Technology Hand Book Daniel Minoli, Emma Minoli McGraw Hill
2. Frontiers of Electronic Commerce Ravi Kalakotar, Andrew B. Whinston Addison-Wesley

<b>IT-325 Computer Networks &amp; Administration</b>	<b>(4-0-0)</b>	<b>4</b>
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1. Computer network architecture, Physical layer: Hardware, topology, data encoding,
2. Data Link Layer: Logical link Control: Error detection and Correction, ARQ protocols, Framing protocols( HDLC, LLC) Medium Access Control: Multiple access protocols, Channel Allocation, contention, reservation, round robin with Examples.
3. Network Inter connection: Generic switches, switch design issues, switching mechanism : virtual Circuit switching, datagram switching, source route switching, Bridge and bridge learning , Global Addressing scheme, fragmentation and reassembly, Address translation: ARP, RARP, ICMP, IP Scalability Issues, sub netting and super netting (CIDR) , IP Routing, EGP, BGP protocols
4. End to End protocols: End to end issues, UDP and TCP segment formats, connection establishment and termination, state transition sliding window protocol, TCP Flow control, Silly window syndrome, TCP retransmission, RTT Estimation, TCP Congestion Control and congestion avoidance protocols
5. Internet applications: Client server paradigm, DNS, SMTP, RPC, NFS and General network security issues.
6. Introduction to Network management protocols. Tools and techniques for network monitoring authentication, and administration.

**Text/References:**

1. Data Networks: Bertsekas and Gallager, Phi.
2. Computer Networking A Top down Approach: J.F.Kurose, Pearson.
3. Computer Networks A Systems Approach: L. Peterson and B. Davie, Elsevier
4. Computer Networks and Internet: D.E. Comer, Pearson

<b>IT-351 Information System Security Lab</b>	<b>(0-0-3)</b>	<b>2</b>
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The following proposed coverage are broad guiding areas in lab. The instructor offering the course in consultation with the theory offered can adopt further variations in tune with IT-321.

1. Implementation of Classic Ciphers.
2. Extended Euclid algorithm implementation.
3. Implementation of DES encryption and decryption.
4. Implementation of Polynomial arithmetic, Galois Fields.
5. Implementation of AES encryption and decryption.
6. Implementation of hash function.
7. Solution of Equations through CRT.
8. Implementation of an authentication scheme.
9. RSA implementation.
10. Digital Signature implementation.

**Text/References:**

1. B Schneier, Applied Cryptography, Wiley. ISBN 0-471-11709-9
2. A.J. Menezes, P.C. van Oorschot and S.A. Vanstone, Applied Cryptography, CRC Press, ISBN 0-8493-8523-7, 1997
3. D.R. Stinson, Cryptography - Theory and practice, CRC Press, ISBN 0-8493-8521-0, 1995

<b>IT-353 Web based Development Lab</b>	<b>(0-0-3)</b>	<b>2</b>
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Topics to be covered in the lab:. Introduction to Web Programming . Installation of PHP/MySQL and web server . Introduction to PHP programming . Writing PHP Programs . Loops, Control Structure and Arrays . PHP functions . String functions . Array functions . Mathematical function . Graphics functions .

File system function . Date and time function . Miscellaneous Functions Error handling Object Oriented Features of PHP File and Directory handling . MySql database . Configuration of MySql server. Starting MySql server . MySql tables . Displaying MySql data . Adding and removing user access . Advance PHP programming . mail . PHP - generated PDF files . Web Servers . IIS web Server . Apache web server.

**Text/References:**

1. Beginning PHP 4 Databases – Christopher Scollo, Harish Rawat, Dipak Thomas, Sanjay Abraham, Andrew Hill & Jim Hubbard; Wrox Press
2. PHP MySql Website Programming – Chris Bea, Mike Duzzard, Jessy White, Cinis & Dilip Thomas; Wrox Press
3. PHP Black Book – Peter Moulding, Coriolis Group
4. MySql – PHP Database Applications – Jay Greenspan & Brad Bulger; John Wiley & Sons
5. PHP MySql Website Programming: Problem-Design-Solutions – Chris Bea, Mike Duzzard, Jessy White, Cinis & Dilip Thomas; Apress
6. Essential PHP for Web Professionals – Christopher Cosentino; Prentice Hall
7. Sam’s Teach Yourself PHP 4 in 24 Hours – Matt Zandstra; SAMS
8. PHP 5.1 For Beginners – Ivan Bayross, O’Reilly, Shroff Publishers & Distributors Pvt. Ltd

<b>IT-355 Network Programming &amp; Administration Lab</b>	<b>(0-0-3)</b>	<b>2</b>
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The following proposed coverage are broad guiding areas lab. The instructor offering the course in consultation with the theory offered can adopt further variations in tune with IT-325.

1. Programming for data encoding, CRC detection and Correction.
2. Estimation of network delay through OS utilities.
3. Simulation and Emulation of Bus and Star topology, DLC, MAC protocols using Benchmark LAN trainer kits.
4. Packet measurement and observation using network sniffing tools.
5. Use of sniffers for protocol dynamics.
6. Installation and working of RRD tool for logging administration data for networks.
7. Bandwidth and other network parameter mechanism through SNMP protocols.

<b>Program Elective I</b>	<b>(3-0-2)</b>	<b>4</b>
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One/More of the following courses as offered by Department.

- IT-371 Programming in Java
- IT-373 Python Programming
- IT-375 Scripting Languages
- IT-377 Management Information Systems

<b>Open Elective III</b>	<b>(X-X-X)</b>	<b>3/4</b>
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Please refer to concerned Department.

<b>B.Tech Information Technology Semester VI</b>
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<b>IT-322 Software Engg.</b>	<b>(3-0-0)</b>	<b>3</b>
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Introductory Concepts: Historical perspective, System Definition, Software Life Cycle, Software

Engineering paradigms.

System analysis: Feasibility study requirement analysis, Cost benefit analysis, Planning systems, Analysis tools and techniques.

System Design: design fundamentals, Modular Design, Data and procedural design, object oriented design.

System Development: Code documentation, Program design paradigms.

Verification, Validation and Testing: testing methods, Formal Program Verification, Testing Strategies.

Software Maintenance: Maintenance Characteristics, Maintainability, Maintenance tasks and side effects.

**Text/References:**

1. Pressman R.S: Software Engineering: A Practitioner approach, McGraw Hill.
2. Sommerville I: Software Engineering, Addison Wesley
3. Ghezzi C. Jazayeri M and Mandrioli: Fundamentals of Software Engg. , PHI.

**IT-324 Compiler Design**

**(3-0-0)**

**3**

Introduction to translators, compilers versus interpreters, compilation process.

Lexical Analysis: Finite automata and Regular expressions, Minimization of finite automata.

Syntax Analysis: Context Free Grammars, Bottom-up and Top-down Parsing. Ambiguity, Shift Reduce Parser, Operator Precedence Parser, Predictive Parsers, LR parsers.

Syntax directed translation: Syntax directed translation, Synthesized and Inherited attributes, Intermediate codes- Postfix, Quadruples, Triples.

Code optimization: Basic blocks, Flow graphs, Local and Global data flow analysis – DAG, ud-chaining, available expressions, Loop optimization.

Code generation: Compilation of expression and control structures. Error detection and recovery.

Symbol table organization: Hashing, linked list, tree structures.

**Text/References:**

1. Aho, Ullman and Sethi: Compilers – Principles, techniques and tools, Pearson Education.
2. Tremblay, Sorenson: The Theory and Practice of Compiler Writing, BSP.
3. Holub, Compiler Design in C, PHI.

**IT-352 Compiler Lab**

**(0-0-3)**

**2**

The following proposed coverage are broad guiding areas in lab. The instructor offering the course in consultation with the theory offered can adopt further variations in tune with IT-324.

1. Programming exercises to implement typical lexical analyzers, parsers, intermediate code generation.
2. Assignments using LEX and YACC tools.
3. Programming assignments on some of the concepts related to Code Optimization.

**Text/References:**

1. Aho, Ullman and Sethi: Compilers, Pearson Education.
2. Levine, Mason and Brown: Lex and Yacc, O'Reilly

**IT-354 Seminar**

**(0-2-0)**

**2**

The topics selection covering the latest and relevant topics related to the emerging areas. Ideally, some recent reputed journal papers abstraction and presentation shall be encouraged for presentation. The evaluation shall be continuous and through components evaluation viz. content, coverage, depth, presentation, response to the queries, and seminar report. In case of unsatisfactory performance, an X grade can be awarded for extension work during summer term.

<b>Program Elective II</b>	<b>(3-0-2)</b>	<b>4</b>
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One/More of the following courses as offered by Department.

- IT-372 Signals and Systems
- IT-374 Object Oriented System Design
- IT-376 Multimedia Technology
- IT-378 Artificial Intelligence

<b>Open Elective IV</b>	<b>(X-X-X)</b>	<b>3/4</b>
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Please refer to concerned Department.

<b>Open Elective V</b>	<b>(X-X-X)</b>	<b>3/4</b>
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Please refer to concerned Department.

<b>B.Tech Information Technology Semester VII</b>
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<b>IT-451 Industrial Training</b>	<b>(0-2-0)</b>	<b>2</b>
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The evaluation shall be continuous and through components evaluation viz. content, coverage, depth, presentation, demonstration, response to the queries, and training report. In case of unsatisfactory performance, and failure extra credit course from the department equivalent to CP-451 can be permitted through consent of DUGC.

<b>IT-453 Free and Open Source Lab</b>	<b>(0-0-3)</b>	<b>2</b>
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The following proposed coverage are broad guiding areas lab. The instructor offering the course in consultation with the theory offered can adopt further variations.

1. Linux basics and installation and management of the Linux.
2. Different types of software development environment (Eclipse)
3. make and other software construction utilities on Linux.
4. Version control and managing project in open source.
5. Managing large software development through wiki or alike project management tools.
6. Introduction to scripting for system management.

<b>Program Elective III</b>	<b>(3-0-2)</b>	<b>4</b>
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One/More of the following courses as offered by Department.

- IT-471 Computer Graphics
- IT-473 Human Computer Interaction
- IT-475 GUI Programming

IT-477 Selected Topics in OS  
IT-479 Mobile and Wireless Computing

<b>Program Elective IV</b>	<b>(3-0-2)</b>	<b>4</b>
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One/More of the following courses as offered by Department.

IT-481 Advanced Compiler  
IT-483 Design and Analysis of Algorithms  
IT-485 Semantic Web  
IT-487 Data Mining and Data Warehousing  
IT-489 Implementation of Data Bases

<b>Program Elective V</b>	<b>(3-0-2)</b>	<b>4</b>
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One/More of the following courses as offered by Department.

IT-491 Information Retrieval  
IT-493 Wireless Sensor Network  
IT-495 Topics in High Speed Networking  
IT-497 Digital Watermarking and Steganography  
IT-499 Software Project Management

<b>IT-455 Project Lab</b>	<b>(0-2-3)</b>	<b>5</b>
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Objective of this elective is to facilitate transfer of knowledge acquired by a student to a field of his own choice for application to solving a problem. Student is expected to collect and study relevant material under mentorship of a faculty member working in similar area; identify a suitable problem and propose methodology towards its solution. Alternately a student can explore hardware implementation of existing solution(s). This elective shall act as prequel to project work for next semester. The project coordinator(s) from the department for continuity shall coordinate this course. Grouping and division shall be applicable as defined in the major project of final semester.

<b>Open Elective VI</b>	<b>(X-X-X)</b>	<b>3/4</b>
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Please refer to concerned Department.

## B.Tech Information Technology Semester VIII

<b>IT-452 Project</b>	<b>(X-X-X)</b>	<b>10</b>
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The major project covers lab component of the final semester work. The evaluation of project shall be continuous and will be done through project coordinator(s). The evaluation mechanism shall be evolved based on the existing practices through DUGC rectified from time to time. Ideally the project should comprise with group size of two students shall be limited to maximum 4 students and the groups shall be evenly distributed among faculty through coordinator(s). Internal and external components shall not exceed 40% each of the overall marks.

<b>IT-454 Group Discussions</b>	<b>(0-0-3)</b>	<b>2</b>	<b>VL</b>
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**This lab will remain only if Industrial training is given weightage of 02 credits.**

<b>Program Elective VI</b>	<b>(3-0-2)</b>	<b>4</b>
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One/More of the following courses as offered by Department.

- IT-470 Digital Forensics
- IT-472 Biometric Security
- IT-474 VLSI Algorithms
- IT-476 Intrusion Detection
- IT-478 Pattern Recognition

<b>Program Elective VII</b>	<b>(3-0-2)</b>	<b>4</b>
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One/More of the following courses as offered by Department.

- IT-480 Multi-Core Architectures
- IT-482 Software Testing
- IT-484 Distributed Systems
- IT-486 Advanced Topics in Databases
- IT-488 Expert Systems

<b>Open Elective VII</b>	<b>(X-X-X)</b>	<b>3/4</b>
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Please refer to concerned Department.

## Program Elective I (Semester V)

### IT-371 Programming in Java

(3-0-2)

4

**Introduction:** Internet, Java as a tool for internet applications, Byte Code and its advantages.

**Object Oriented Programming and Design:** Review of Abstraction, Objects and other basics, Encapsulation, Information hiding, Method, Signature, Classes and Instances, Polymorphism, Inheritance, Exceptions and Exception Handling with reference to object modeling, Coupling and Cohesion in object oriented software. Object Oriented Design – Process, Exploration and Analysis.

**Java Programming Basics:** Fundamentals: Variables and assignments, Input and Output, Data Types and Expressions, Flow of control, Local variables, Overloading Parameter passing, this pointer,

**Java Object Oriented Concepts:** Objects and Classes: Use of file for I/O, Formatting output with stream functions, Character I/O, Inheritance, Public and private members, Constructors for initializations, Derived classes, Flow of Control

#### Java Data Structures and Advanced Topics

Arrays – Programming with arrays, arrays of classes, arrays as function arguments, Strings, Multidimensional arrays, Arrays of strings, vectors, Base classes.

Introduction to Java Applets

#### Text/References:

1. Herbert Schildt: JAVA 2 - The Complete Reference, TMH, Delhi
2. U.K. Chakraborty and D.G. Dastidar: Software and Systems - An Introduction, Wheeler Publishing, Delhi.
3. Joseph O'Neil and Herb Schildt: Teach Yourself JAVA, TMH, Delhi.

### IT-373 Python Programming

(3-0-2)

4

Introduction to Python: Data types, variables, expressions, operators. Sequence, set, dictionary, print statement, control-flow statements, functions.

Objects and classes, metaclasses. Decorators, special methods. Exception handling. Modules sys, os, etc. Strings and regular expressions. File operations.

Working with processes and threads. Pipes and signals

Graphical user interface design in Python (including the *Tkinter* module), Widgets and basic components, Layout options, Event handling

Network scripting (sockets, FTP, and e-mail clients), Server-side scripting

Databases and persistence in Python (including *pickled* objects and *shelf* files)

Custom and built-in data structures in Python

C integration with Python (including the SWIG module), Embedding Python calls within C

#### Text/References:

8. Programming Python by Mark Lutz, O'Reilly.
9. Learning Python, 3rd Edition by Mark Lutz, O'Reilly
10. Python in a Nutshell by Alex Martelli, O'Reilly.
11. An Introduction to Python by Guido van Rossum and Jr. Fred L. Drake, Network Theory Ltd.

### IT-375 Scripting Language

(3-0-2)

4

Shell and Scripting languages introduction. AWK, Perl, and Python programming paradigms.

#### Text/References:

1. Relevant online material with the latest version of the scripting languages.

<b>IT-377 Management Information Systems</b>	<b>(3-0-2)</b>	<b>4</b>
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Interpretation and understanding of information, need and role of information technology in business and organization.

Information system: Basic elements, data, information, knowledge, infrastructure and types and its development. Organizing data and information: Basics of data arrangement and access, data knowledge & decision support, DBMS – An overview.

Introduction to management information system

Hardware and software used for information systems, transaction processing, office automation.

Decision making process, concepts of information, humans as information processors, system concepts, organizational structure and management concepts.

**Text/ References :**

1. Management Information and System, Davis and Olson, Mc-graw Hill.
2. Recent papers from conferences and journals.

<b>Program Elective II (Semester VI)</b>
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<b>IT-372 Signals and Systems</b>	<b>(3-0-2)</b>	<b>4</b>
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Review of signal description

Review of Fourier and Laplace transforms

Spectrograms; frequency modulation

Sampling and aliasing

The z-transform

Filters: Transfer functions, FIR filters, IIR filters

Spectral analysis: DFT for periodic signals, DFT for non-periodic signals

**Texts/References:**

1. J H McClellan, R W Schafer & M A Yoder, *DSP First: a Multimedia Approach*, Prentice-Hall International 1998
2. A V Oppenheim , R W Schafer & J R Back, *Discrete-time Digital Signal Processing*, Prentice Hall Int 1999. Third major revision of classic text
3. A V Oppenheim , A S Willsky & S H Nawab, *Signals and Systems*, Prentice Hall Int 1996.
4. N K Sinha, *Linear systems*, John Wiley 1991
5. J G Proakis and D G Hanolakis, *Digital Signal Processing*, Maxwell Macmillan Int 1992

<b>IT-374 Object Oriented System Design</b>	<b>(3-0-2)</b>	<b>4</b>
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**Object Oriented Programming and Design:** Review of abstraction, objects and other basics, Encapsulation, Information hiding, method, Signature, Classes and Instances, Polymorphism and inheritance.

**C++ Programming Basics:** Fundamentals, variables and assignments, Input and Output, Data types and expressions, flow of control, subprograms, top-down design, predefined functions, user defined functions, procedural abstractions, local variables, overloading function names, operator overloading, parameter passing, this pointer, destructors, copy constructor, overloading the assignment operator, virtual functions, function calling functions, friend functions, recursive functions, recursive member functions. Static member function.

**C++ Object oriented concepts:** Objects and classes, use of file for I/O, formatting output with stream functions, Character I/O, inheritance, structures for diverse data, structures as function arguments, initializing structures, defining classes and member functions, public and private members, constructors for initialization, standard C++ classes, derived classes, flow of control, use of Boolean expressions, multiway branches, use and design of loops. Friend function and friend class.

**C++ Data structures and Advanced Topics:** Arrays – programming with arrays, arrays of classes,

arrays as function arguments, strings, Multidimensional arrays, Arrays of strings, pointers Dynamic arrays, Classes and dynamic arrays, Base classes, access control, Templates- generic classes and functions, namespaces. Standard Template Library.

**Text/References:**

1. Balaguruswamy: Object-oriented Programming with C++.
2. Robert Lafore: C++ Programming
3. Ashok N. Kamthane : Object Oriented with C++, Pearson Education

**IT-376 Multimedia Technology**

**(3-0-2)**

**4**

Introduction to Multimedia, Graphics and Image data representations, Color in image and video CIE, RGB, CMY, HSL color models

Fundamental concepts in video, NTSC, PAL and Digital video

Compression methods: Lossy and Loss less compression techniques.: Huffman coding, Arithmetic coding, LZW

Image compression standards: DCT Transform and Fourier transforms, JPEG coding

Video representation and compression techniques

Motion vector search: sequential, 2D logarithmic search.

I, P and B frames, MPEG Video coding, MPEG-1, MPEG-2 and MPEG-3: video coding and decoding

Basic Audio compression: Fletcher- Munson curves, Critical Bands, Psychoacoustic phenomenon, MPEG Layer 3 (MP3) Audio

**Text/References:**

**IT-378 Artificial Intelligence**

**(3-0-2)**

**4**

Overview of AI, Problems, Problem space and searching techniques, Definition production system, Control strategies, Heuristic search techniques.

Knowledge representation: Representation, mappings, approaches and issues, Predicate logic, propositional logic, Resolution, Procedural and declarative knowledge, forward and backward reasoning, Matching, Semantic nets, Frames scripts.

Learning and learning systems: Introduction to Hopfield networks, introduction to neural networks, learning in neural networks, applications of neural networks, Recurrent network.

Natural Language Processing, Perceptions and actions.

Introduction to Expert Systems, Definition types, Component, development process.

Introduction to AI languages: PROLOG and LISP.

**Text/References:**

1. Artificial Intelligence: Elaine Rich, Kevin Knight, Mc-Graw Hill.
2. Introduction to AI & Expert System: Dan W. Patterson, PHI.

**Program Elective III (Semester VII)**

**IT-471 Computer Graphics**

**(3-0-2)**

**4**

**Introduction to computer graphics:** Vector and Raster graphics, Graphic primitives and attributes. Computer graphics devices - CRT, plasma, LCD, plotters, Scan conversion of line, circle and ellipse.

**Viewing Transformations:** Coordinate system - world, device and normalized device coordinates, Window and Viewport and viewing transformations

**Filling and Clipping** - Flood fill and seed fill algorithms and scan line polygon filling algorithms,

Cohen Sutherland clipping algorithms for Polygon

**Geometric transformations** - 2D and 3D transformations: Translation, Scaling, rotation, Shearing, reflection etc., Transformations about an arbitrary axis

**Projections:** Parallel - Orthographic, Plans and Elevations, Axonometric - Isometric, Diametric, trimetric, Perspective - One point, two point, three point.

**Hidden surface removal:** Object space and image space algorithms, Back space removal, Z-buffer, scan line, area subdivision, painters, BSP tree, Floating horizon and ray tracing methods

**Curves:** Spline representations, Curve representation techniques, Continuity constraints, Hermite Interpolation, Bezier curves, B-Spline curves

**Text/References:**

1. Foley, Van Dam. Computer Graphics: Principles and Practic. Addison Wesley.
2. Hearn and Baker. Computer Graphics. PHI.
3. Rogers and Adams. Mathematical Elements of Computer Graphics. McGraw Hill.
4. Rogers and Adams. Procedural Elements of Computer Graphics. McGraw Hill.

**IT-473 Human Computer Interaction**

**(3-0-2)**

**4**

Human factors issues in the development of software, use of database systems, and design of user interfaces for interactive systems. Science base (theories, models, usability studies, and controlled experimentation), and software engineering with user interface development environments. Issues include: command languages, menus, forms, and direct manipulation, graphical user interfaces, computer supported cooperative work, information search and visualization, World Wide Web design, input/output devices, and display design.

**Text /References:**

1. B. Shneiderman, Designing the User Interface, 3rd Edition, Addison-Wesley, (1998)
2. Interaction Design by Jenny Preece, Yvonne Rogers, and Helen Sharp. John Wiley & Sons: New York, 2002. ISBN: 0471492787.
3. User Centered Web Site Design, by D.D. McCracken and R.J. Wolfe. Pearson Prentice Hall: Upper Saddle River, NJ, 2004. ISBN: 013041161-2.
4. The Web Wizard's guide to Web Design, J.G. Lengel, Addison-Wesley, 2002. ISBN: 0201745623.

**IT-475 GUI Programming**

**(3-0-2)**

**4**

Issues and Challenges in GUI design. Overview of intelligent interface design. Graphics versus web interface. Principles of good interface. System Menu and Navigation schemes. Interaction devices. Screen based controls. Usability, testing, design for web, humans. Colors.

**Text/ References:**

1. Wilbert O. Galitz. The Essential Guide to User Interface Design. Wiley.
2. Susan Weinschenk, Pamela Jamar, Sarah C. Yeo. GUI Design Essentials (Paperback)
3. Jenifer Tidwell. Designing Interfaces: Patterns for Effective Interaction Design, O'Reilly.
4. B. Shneiderman, Designing the User Interface, 3rd Edition, Addison-Wesley.

**IT-477 Selected Topics in OS**

**(3-0-2)**

**4**

Processes and Threads, Concurrency control, Directory and File structure, File sharing, NFS, Storage management.

Design issues of Distributed OS, Distributed v/s network operating system.

Communication: Client Server, RPC

Distributed OS: Issues, process management, inter-process communication, scheduling, deadlocks  
 Design and implementation of distributed file systems, distributed shared memory  
 Security: Concepts and Distributed Systems  
 Distributed Concurrency, Transactions.  
 Case study: Unix, Amoeba.

**Text/References:**

1. Operating System A Design Approach-Crowley, TMH.
2. Tanenbaum: *Distributed Operating Systems*, Pearson Education.
3. Bach, *Design of Unix O/S*.
4. Coulouris et al, *Distributed Systems: Concepts and Design*, Addison Wesley.
5. Mullender: *Distributed Systems*, Addison Wesley.
6. Tanenbaum and Steen: *Distributed Systems: Principles and Paradigms*, Pearson Education

**IT-479 Mobile and Wireless Computing**

**(3-0-2)**

**4**

Wireless communication fundamentals: Introduction, wireless transmission, frequencies for radio transmission, signals, antennas, signal propagation, multiplexing, modulations, spread spectrum, MAC, SDMA, FDMA, TDMA, CDMA, cellular wireless networks.

Telecommunication networks: Telecommunication systems :GSM,GPRS, DECT, UMTS, IMT-2000, Satellite networks - basics – parameters and configurations – capacity allocation: FAMA and DAMA.

Wireless LAN: IEEE- 802.11, architecture, services, MAC, physical layer, IEEE 802.11a, 802.11b standards, HIPERLAN, BLUE TOOTH.

Mobile network layer: mobile ip, dynamic host configuration protocol, routing, DSDV, DSR .

Transport and application layers : traditional TCP, classical TCP improvements – WAP, WAP 2.0.

**Text/References:**

1. Jochen Schiller, “Mobile Communications”, PHI/Pearson Education, Second Edition, 2003.
2. William Stallings, “Wireless Communications and Networks”, PHI/Pearson Education, 2002.
3. Kaveh Pahlavan, Prasanth Krishnamoorthy, “Principles of Wireless Networks”, PHI/Pearson Education, 2003.
4. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, “Principles of Mobile Computing”, Springer, New York, 2003.
5. Hazysztov Wesolowshi, “Mobile Communication Systems”, John Wiley and Sons Ltd, 2002.

**Program Elective IV (Semester VII)**

**IT-481 Advanced Compiler**

**(3-0-2)**

**4**

A Tour of Compiler Design, LR Parsers – SLR parsers, Canonical LR and LALR parsers, Lex and Yacc Tools, Control-flow Analysis, Control-flow Graphs, Basic Blocks, Data-flow Analysis, Dependence Analysis, Global Optimizations, Loop Optimizations, Dominators, Loop-invariant computations, Code motion, Data Dependence Analysis in Loops, Loop Scheduling, Runtime System Architectures and Automatic Memory Management Techniques.

**Text/References:**

1. Aho, Alfred V., Sethi, Ravi, Ullman, Jeffrey D., Compilers: Principles, Techniques and Tools, Addison-Wesley.
2. Steven Muchnick, Advanced Compiler Design & Implementation, Morgan Kaufmann.
3. Keith Cooper and Linda Torczon, Engineering a Compiler, Morgan Kaufmann.

**IT-483 Design and Analysis of Algorithms**

**(3-0-2)**

**4**

**Review of Algorithms:** Searching and Sorting, Tree and Graph traversal. DFS and its applications. Shortest path algorithms, minimum spanning tree algorithm. Algorithm Design Techniques: Greedy algorithm, dynamic programming, divide and conquer, backtracking, branch and bound.

**Algorithm Analysis:** Asymptotic notation, solution of recurrence, model of computation, time and space complexities, average and worst case analysis, Amortized analysis. Master's theorem. Recurrence solving.

**Graph Algorithms:** network flow, matching, coverings, applications of DFS:- bi-connectivity, Euler circuits, strongly connected components, topological sort, and articulation point. Network Flow.

**Greedy Algorithms:** Knapsack problem.

**Dynamic Programming:** Chained matrix multiplication, longest common subsequence.

Divide and Conquer: Order Statistics – finding the median, exponentiation, matrix multiplication, LCS.

**Approximate Algorithm:** Travelling Salesman Problem, vertex-cover problem.

Randomized Algorithms:

**Matrix Algorithms** – Strassen Matrix multiplication, LUP decomposition.

**Number Theoretic Algorithms:** Primality Testing, Factorization.

**Miscellaneous:** Introduction to approximate, randomized and probabilistic algorithms.

Introduction to problem classes – NP, NPC, NP-Hard.

**Text / References:**

1. Cormen, Leiserson, Rivest: *Introduction to Algorithms*, Prentice Hall of India.
2. Horowitz and Sahani: *Fundamental of Computer algorithms*.
3. Aho A.V , J.D Ulman: *Design and analysis of Algorithms*, Addison Wesley
4. Brassard : *Fundamental of Algorithmics*, PHI.
5. W.W. Peterson and E. J. Weldon: *Error correcting codes*.
6. Sara Baase, Allen Van Gelder: *Computer Algorithms: Introduction to Design and Analysis*, Pearson Education.

**IT-485 Semantic Web**

(3-0-2)

4

Basics of knowledge representation and informal introduction to OWL. Description logics and classiers - the ALC family and its extensions. Expressiveness versus tractability; highly expressive description logics; implemented description logic systems; description logics and the "Semantic Web". Practical issues in ontologies: Basic principles, normalisation and the "Ontoclean" methodology, upper ontologies, Common problems in ontology development: parts and wholes, time, space, fundamental limitations.

**Text/References:**

1. The Description Logic Handbook, Baader et al, CUP, 2003.
2. Ian Pratt. Artificial Intelligence. Macmillan, 1994.
3. John Sowa. Principles of Semantic Networks: Explorations in the representation of knowledge. Morgan Kaufmann, 1991.
4. Russell and Norvig. Artificial Intelligence: A Modern Approach. Prentice Hall, 1995.
5. Han Reichgelt. Knowledge Representation: An AI Perspective. Ablex Publishing, 1991.

**IT-487 Data Mining and Data Warehousing**

(3-0-2)

4

Introduction to Decision Support Systems, Data Warehouse and Online Analytical Processing. Data Warehouse Architecture: System

Processes, Process Architecture: Load Warehouse, Query, Detailed and Summarized Information.

Design: Data Base Schema Facts, Dimensions and Attributes. Introduction to Data Base and Metadata.

Data Warehouse Implementation.

Data Mining : Introduction and need.

Data Processing : Data Cleaning, Data Integration and Transformation, Data Reduction.

Data Mining Primitives : Descriptive and Predicative Data Mining, Language DMQL and its Preliminary Clauses.

Data Mining Methods: Association – Single and Multilevel, Characterization and Comparison, Regression Analysis, Classification and Predication.

Data Mining Algorithms: Clustering, Association, Regression, Decision Trees.

OLAP : OLAP Architecture, ROLAP, and MOLAP. Application and Trends in Data Mining.

**Text/References:**

1. Data Warehousing in the Real World – Anahory and Murray, Pearson Education.
2. Data Mining – Concepts and Techniques – Jiawei Han and Micheline Kamber.
3. Building the Data Warehouse – WH Inmon, Wiley.

**IT-489 Implementation of Data Bases**

**(3-0-2)**

**4**

Issues in Implementation of Centralized Database Systems - Query Processing, Query Optimization, Transaction Processing, Concurrency, Recovery Management.

Database System Architectures – Centralized and Client-Server architecture, Parallel Systems, Distributed Database Systems.

Implementation of Distributed Database Systems- Distributed Data Storage, Distributed Transactions, Concurrency control in Distributed Database Systems, Distributed Query Processing.

**Text & References:**

1. Silberschatz A, Korth HF, Sudarshan S, Database System Concepts, McGrall Hill.
2. Elmasri R and Navathe SB, *Fundamentals of Database Systems*, 3rd Edition, Addison Wesley,2000. This book covers most of the material on the course.
3. Ceri S, Pelagatti G, Distributed Databases – Principles and Systems, McGraw Hill.

**Program Elective V (Semester VII)**

**IT-491 Information Retrieval**

**(3-0-2)**

**4**

INTRODUCTION- Information storage and retrieval systems, Data Structures and Algorithms Related to Information Retrieval

RETRIEVAL STRATEGIES - Vector Space Model, Probabilistic Retrieval Strategies, Language Models, Inference Network, Extended Boolean retrieval, Latent Semantic Indexing

RETRIEVAL UTILITIES - Relevance Feedback , Clustering, Passage-Based Retrieval, N-grams, Regression Analysis, Thesauri, Stemming, Semantic Networks, Parsing, Ranking

EFFICIENCY- Inverted Index, Query Processing, Signature Files, Duplicate Document Detection

INTEGRATING STRUCTURED DATA AND TEXT - Review of the Relation Model, A Historic Progression, Information Retrieval as a Relational Application, Semi-Structured Search using a Relational Schema, Multi-dimensional Data Model

**Text/References:**

1. Information Retrieval Data Structures & Algorithms by William B. Frakes, Ricardo Baeza-Yates
2. Information retrieval- by D A Grossman , Ophir Frieder, Springer International Edition

**IT-493 Wireless Sensor Networks**

**(3-0-2)**

**4**

Introduction – motivation, applications, sensors, architectures, platforms for WSN

Actual Systems - Berkeley motes, TinyOS and nesC. Wireless Radio Realities – radio irregularities and impact on protocols. MAC protocols – S-MAC, multi-channel MAC.

Routing –Geographic routing, DSR, AODV, Directed Diffusion, SPEED.

Clock Synchronization - FTSP, TPSN. Localization – TDOA, Walking GPS, range free solutions .Power Management – per node, system-wide, sentry services, sensing coverage

Data Services and Databases – architectures, queries (SQL), data dissemination.  
 Programming Abstractions – programming models, EnviroTrack, new APIs  
 Security and Privacy – problems, attacks, solutions, open research areas. Case Study: A Complete System  
 – surveillance and tracking application. How to program actual WSN.

**Text/References**

1. *Protocols and Architectures for Wireless Sensor Networks*. H. Karl and A. Willig. John Wiley & Sons, June 2005.
2. *Wireless Sensor Networks: Technology, Protocols, and Applications*. K. Sohrawy, D. Minoli, and T. Znati. John Wiley & Sons, March 2007.
3. *Wireless Sensor Networks*. C. S. Raghavendra, K. M. Sivalingam, and T. Znati, Editors. Springer Verlag, Sep. 2006.
4. *Wireless Sensor Networks: Architectures and Protocols*. E. H. Callaway, Jr. AUERBACH, Aug. 2003.
5. *Networking Wireless Sensors*. B. Krishnamachari. Cambridge University Press, Dec. 2005.
6. *Wireless Sensor Networks: An Information Processing Approach*. F. Zhao and L. Guibas. Morgan Kaufmann, Jul. 2004.
7. *Sensor Networks and Configuration: Fundamentals, Standards, Platforms, and Applications*. N. P. Mahalik. Springer Verlag, Nov. 2006.
8. *Wireless Sensor Networks: A Systems Perspective*, N. Bulusu and S. Jha, Editors, Artech House, August 2005.

**IT-495 Topics in High Speed Networking**

**(3-0-2)**

**4**

Overview of Internet Technologies, Issues in next generation Internet - Routing, Multicasting, Packet Scheduling, Quality of Service etc. Admission control in Internet: Effective bandwidth, Differentiated services, Policy-based networking, Real time communications over Internet, Internet telephony, Voice over IP, Integrated services. Web QoS, Intelligent caching, Traffic measurement and characterization.

**Text/ References:**

1. Kurose: *Computer Networking A Top Down Approach*, Pearson.
2. Peterson and Davie: *Computer Networks: A systems approach*, Morgan Kaufman and Elsevier.
3. J.Walrand, *High Performance Computer Networks*, Elsevier
4. A.Kumar, D.Manjunath, *Communication Network MKP*.
5. Recent papers from conferences and journals.

**IT-497 Digital Watermarking and Steganography**

**(3-0-2)**

**4**

Watermarking: Applications, techniques, models, detection techniques. Visible and invisible watermarks. Embedding. Robust watermarking, watermark security.  
 Steganography – Least Bit, DCT, Spread spectrum. Audio steganography.  
 Steganalysis techniques.

**Text/References:**

1. Ingemar Cox, Matthew Miller, Jeffrey Bloom, and Jessica Fridrich . *Digital Watermarking and Steganography*, 2nd Ed, (The Morgan Kaufmann Series in Multimedia Information and Systems). (Hardcover - Nov 16, 2007)
2. Frank Y. Shih. *Digital Watermarking and Steganography: Fundamentals and Techniques*, CRC Press.g
3. Stefan Katzenbeisser, Fabien, and A.P. Petitcolas. *Information Hiding Techniques for Steganography and Digital Watermarking*, Artech House.
4. Neil F. Johnson; Zoran Duric; Sushil Jajodia. *Information Hiding: Steganography and Watermarking - Attacks and Countermeasures*, Springer.

5. Gregory Kipper. *Investigator's Guide to Steganography*, Auerbach Publications.

**IT-499 Software Project Management**

**(3-0-2)**

**4**

Software Project Management Concept: The Management Spectrum, People, Product, Process & Project. Software Process & Project Matrix: Software Measurement, Size Oriented Matrices, Function Oriented Matrices.

Software Project Planning: Objectives, Decomposition Techniques and Empirical Estimation Model. Risk Analyses and Management: Risk Identification, Projection, Risk Identification, Projection, Risk Refinement, Risk Monitoring and Management.

Project Scheduling & Tracking, Software Quality Assurance, Software Configuration Management.

**Text /References:**

5. R. S. Pressman, Software Engineering
6. P. Jalote, Software Project Management in Practice.
7. B. Hughest & M. Cotterell, Software Project Management.

**Program Elective VI (Semester VIII)**

**IT-470 Digital Forensics**

**(3-0-2)**

**4**

**File System Forensics:** Duplicating hard disks for "dead analysis", reading hidden data on a disk's Host Protected Area (HPA), Direct versus BIOS access, dead versus live acquisition, Disk partitions - DOS, Apple, and GPT partitions, BSD disk labels, Sun Volume; multiple disk volumes - RAID and disk spanning; Analyzing FAT, NTFS, Ext2, Ext3, UFS1, and UFS2 file systems, Finding evidence: File metadata, recovery of deleted files, Using The Sleuth Kit (TSK), Autopsy Forensic Browser, and related open source tools

**Web Forensics:** network-based evidence in Windows and Unix environments, Reconstructing Web browsing, e-mail activity, Tracing domain name ownership and the source of e-mails

**System Forensics:** Windows Registry changes, Duplicating and analyzing the contents of PDAs and flash memory devices

Electronic document, computer image verification and authentication

**Texts/References:**

1. Brian Carrier. *File System Forensic Analysis*, Addison Wesley.
2. Chris Prosise, Kevin Mandia. *Incident Response and Computer Forensics*, McGraw Hill.
3. Linda Volonino, Reynaldo Anzaldua, and Jana Godwin. *Computer Forensics: Principles and Practices*, Prentice Hall.
4. Keith J. Jones, Richard Bejtlich, and Curtis W. Rose. *Real Digital Forensics: Computer Security and Incident Response*, Addison Wesley
5. Vacca, John R., *Computer Forensics Computer Crime Scene Investigation*, Charles River Media.
6. Nelson, Phillips, Enfinger, Stuart. *Guide to computer Forensics and Investigation*, Course Technology.
7. Papers from Journals/Conferences.

**IT-472 Biometric Security**

**(3-0-2)**

**4**

Biometrics: Need, Conventional techniques of authentication, challenges - legal and privacy issues. Biometrics in use: DNA, fingerprint, Iris, Retinal scan, Face, hand geometry, human gait, speech, ear. Handwriting, Keystroke dynamics, Signature

Multimodal biometrics: Combining biometrics, scaling issues.  
Biometric template security.

**Texts/References:**

1. Julian D. M. Ashbourn, Biometrics: Advanced Identify Verification: The Complete Guide
2. Davide Maltoni (Editor), et al, Handbook of Fingerprint Recognition
3. L.C. Jain (Editor) et al, Intelligent Biometric Techniques in Fingerprint and Face Recognition
4. John Chirillo, Scott Blaul, Implementing Biometric Security

**IT-474 VLSI Algorithms**

**(3-0-2)**

**3**

1. Introduction of VLSI Technology, VLSI design cycle, design styles, basic Layout rules and circuit abstraction, introduction to standard Cell, Gate array, FPGA
2. Overview of basic graph algorithms, Graph algorithms for physical Design
3. Partitioning: Classification of partitioning algorithms, Karnighan-Lin Algorithm, FM Algorithm, Ratio cut algorithm
4. Floor-planning: Rectangular dual graph approach of floor-planning, hierarchical tree based approach, Integer programming based floor-planning.
5. Placement: placement by simulated annealing and force directed method
6. Routing: classification of routing algorithms, Global routing: Maze routing algorithms, line probe algorithms, Steiner tree based algorithms, Detailed Routing: Single layer and two layer routing algorithms, routing in FPGAs

**Text/References:**

1. Naveed Shervawani, “ Algorithms for VLSI physical Design Automation “ III Ed Springer
2. Sarrafzadeh and Wong “ An introduction to VLSI Physical design “ MGH
3. Sze: VLSI Technology
4. Weste and Eshranghan, “ Introduction toVLSI Design”. Pearson Edu.
5. Sadiq M. Sait, Habib Youssef, "VLSI Physical Design Automation: Theory and Practice", World Scientific Publishing Company;
6. Cormen Leiserson, Rivest, “ Introduction to Algorithms”, Pearson Edu.

**IT-476 Intrusion Detection**

**(3-0-2)**

**4**

Introduction- Intrusion detection system (IDS), intrusion prevention system (IPS), Unauthorized access – buffer overflow, packet fragmentation, out-of-spec packets. Review of Network protocol – TCP/IP. Intrusiond detection through tcpdump. IDS and IPS – Architecture and internals. Malicious and non-malicious traffic, IP headers, TDP, UPD and ICMP protocols and header formats, Header information to detect intrusion, logs and their analysis, IDS through reaction and response Intrusion analysis – data correlation, tools, SNORT.

**Text/References:**

1. Matt Fearnow, Stephen Northcutt, Karen Frederick, and Mark Cooper. *Intrusion Signatures and Analysis*, SAMS.
2. Carl Endorf, Gene Schultz, Jim Mellander, *Intrusion Detection and Prevention*, McGraw Hill.
3. Stephen Northcutt and Judy Novak. *Network Intrusion Detection*, SAMS.
4. Paul E. Proctor. *The Practical Intrusion Detection Handbook*, Prentice Hall.

**IT-478 Pattern Recognition**

**(3-0-2)**

**4**

Digital Image Fundamentals: Image Model, Sampling, Quantization, Neighborhood, connectivity of pixels, Labelling of connected components, Distance measures  
Image Transforms: Fourier Transform, Discrete Fourier Transform, Properties of 2D Discrete Fourier

Transform, The fast Fourier Transform and its algorithm, number of operations, the inverse FFT.  
 Discrete Cosine Transform and its applications, KL Transform, Convolution and correlation  
 Image Enhancement: Enhancement by point processing, spatial filtering, enhancement in frequency domain, generation of spatial masks from frequency domain specifications  
 Image Segmentation: Detection of discontinuities, edge linking and boundary detection, thresholding, region oriented segmentation  
 Representation and Description: Representation schemes, boundary descriptors, regional descriptors.  
 Morphology: Dilation, erosion, opening, closing, Hit-or-Miss Transform, some basic morphological algorithms like pruning, thinning and thickening

**Text/References:**

1. Gonzalez and Woods. Digital Image Processing, Addison Wesley.
2. Castleman. Digital Image Processing. Prentice Hall.
3. Duda and Hart. Pattern Classification. John Wiley.

**Program Elective VII (Semester VIII)**

**IT-480 Multi-Core Architectures (3-0-2) 4**

Multiple core programming models. GPGPU programming and streaming data processing. Issues related with coherency, languages and communication overheads in multi-core programming.

**Text/References:**

1. Art of Multiprocessor Programming: Nir Shavit, Elsevier.

**IT-482 Software Testing (3-0-2) 4**

Basic software testing principles - Software testing, test case generation and test management.  
 Acceptance Testing: User acceptance testing, alpha and beta testing. Verification and Validation, Functional and Non-functional system testing. Software quality assurance.  
 Static and dynamic testing, Black-box or functional testing, structural, white box or glass box testing.  
 Integration testing, component testing.

**Text/References:**

1. Recent papers from conferences and journals.
2. A. P. Mathur, Fundamentals of software testing.

**IT-484 Distributed Systems (3-0-2) 4**

Introduction: What is a distributed system? Main characteristics. Advantages/Disadvantages. Design goals. Main problems. Models of distributed systems.  
 Communication in Distributed Systems: Message passing and the client/server model. Remote Procedure Call. Group Communication.  
 Time and State in Distributed Systems: Time in distributed systems. Logical clocks. Vector clocks. Causal ordering of messages. Global state and state recording.  
 Distributed Mutual Exclusion: Mutual exclusion in distributed systems. Non-token based algorithms. Token based algorithms. Distributed elections.  
 Transaction and concurrency control: Introduction. Transactions. Nested transactions. Locks. Optimistic concurrency control. Timestamp ordering. Comparison method of concurrency control  
 Distributed Transactions: Introduction. Flat and nested distributed transactions. Atomic commit protocols, Concurrency control in distributed transactions, Distributed deadlocks. Transaction recovery

Replication: Motivation for replication. Consistency and ordering. Total and causal ordering. Update protocols and voting.

Recovery and Fault Tolerance: Transaction recovery. Checkpointing and recovery. Fault tolerance in distributed systems. Hardware and software redundancy. Byzantine agreement.

File Systems: Introduction, File Service Architecture. Sun network file system. The Andrew File system. Recent Advances

**Text/References:**

1. Distributed Systems: Concepts and Design, 4rd ed by Coulouris, G, Dollimore, J., and Kindberg, T., Addison-Wesley, 2006. ISBN: 0321263545
2. Distributed Systems: Principles and Paradigms, 2nd ed by Tanenbaum, A. and van Steen, M., Prentice Hall, 2007. ISBN: 0132392275.

**IT-486 Advanced Topics in Data Bases**

**(3-0-2)**

**4**

Transaction Management - Transaction Processing, Concurrency Control, Recovery Management.

Advanced SQL – Complex queries, Nested Subqueries, Views, Materialized Views, Triggers, Referential Integrity, Security and Authorization.

Query Processing and Query Optimizations.

Database System Architectures, Distributed Databases, Distributed Transactions, Distributed Query Processing.

**Text/References:**

1. Silberschatz A, Korth HF, Sudarshan S, Database System Concepts, McGrall Hill.
2. Elmasri R and Navathe SB, *Fundamentals of Database Systems*, 3rd Edition, Addison Wesley,2000. This book covers most of the material on the course.
3. Date CJ, *An Introduction to Database Systems*, 7th Edition, Addison Wesley.

**IT-488 Expert Systems**

**(3-0-2)**

**4**

Overview of AI, Problem space and searching techniques, Production system, Control strategies, Heuristic search techniques, Knowledge representation acquisition and learning.

Introduction to Expert Systems, Definition types, Component, development process. Architecture of Expert System, Case studies and expert system development tools.

Introduction to AI languages: PROLOG and LISP.

**Text/References:**

1. Artificial Intelligence: Elaine Rich, Kevin Knight, Mc-Graw Hill.
2. Introduction to AI & Expert System: Dan W. Patterson, PHI.
3. Fundamentals of expert system, S.N. Sharan, CBS Publishers.