Goa University

P.O. Goa University, Taleigao Plateau, Goa 403 206, India

Syllabus of B Sc (Computer Science) Programme

Approved by the Board of Studies on 15th May 2006

A brief description of the course.

The course for the degree of Bachelor of Computer Science (B.Sc.) is of three years duration. The semester system with continuous evaluation has been adopted for the course. The UGC recommended curriculum with certain modifications as per the specific needs has been introduced.

- Purpose

The course aims to give the students a sound background in theory and practice of Computer Svince in various fields. It comprises of various software and hardware subjects. The syllabus of the course conforms to the requirements prescribed by the Goa University.

- Prerequisites

Admission criteria is First Come First Serve for students who have passed XII Science with PCM combination.

Students must have obtained at least a minimum of 40% marks in PCB at XII Science.

- Number of semesters, how the courses are distributed
  It consists of six semesters, and semester-wise papers are given as follows:

FY/SY/TY BSc (Computer Science course structure) wef 2006-07

Semester I		Periods	Marks			Grand Total	Page Number
			CIA	ESE	Pract		
Paper I	Introduction to Problem Solving and Programming in C	3T + 3P	15	60	25	100	3
Paper II	Mathematical Foundations of Computer Science	3T + 3P	15	60	25	100	4

Semester II							
Paper I	Data Structures using C	3T + 3P	15	60	25	100	6
Paper II	Computer Organization	3T + 3P	15	60	25	100	7
Semester III							
Paper I	Operating Systems	3T + 3P	15	60	25	100	9
Paper II	DBMS-I	3T + 3P	15	60	25	100	10
Semester IV							
Paper I	Object Oriented Programming in Java	3T + 3P	15	60	25	100	11
Paper II	DBMS-II	3T + 3P	15	60	25	100	12
Semester V							
Paper I	Software Engineering-I	4T	20	80		100	13
Paper II	Computer Networks-I	4T	20	80		100	16
Paper III	Web Technology	4T	20	80		100	19
Paper IV	Microcontroller Architecture & Programming	4T	20	80		100	20
Paper V	UML & Web Technology	8P			100	100	22
Paper VI	Networking & Microcontroller	8P			100	100	23
	Project Paper	2	--			--	
Semester VI							
Paper I	Software Engineering-II	4T	20	80		100	24
Paper II	Computer Networks-II	4T	20	80		100	26
Paper III	Simulation & Modeling	4T	20	80		100	27
Paper IV	Modern Development Frameworks	4T	20	80		100	29
Paper V	CASE Tools,. NET framework	8P			100	100	30
Paper VI	Simulation, Network Programming	8P			100	100	31
	Project Paper	2	50	50		100	32

- For FYBSc, any other paper from Foundation course my be allotted in place of Information Technology.
- For SYBSc the foundation course in E-Commerce or E-Governance should be offered.
- Subject combination for First and Second year could be Physics, Mathematics, Computer Science and Electronics, Mathematics, Computer Science
- Personal Computers in the lab should be **replaced / upgraded** once in 3 years.

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Syllabus

FYBSc (Computer Sc.) Semester I

Paper I : Introduction to problem solving and programming in C

Objective:

The objectives of the course are to make the student understand structured programming, use of algorithm for problem solving and various constructs of computer program.

I. Syllabus : Theory(75 marks)

1. Computer Programming: Basic model of computation, Algorithm, flow-chart, program, programming languages, compilation, interpretation, linking & loading, testing and debugging, documentation.
2. Problem solving : Exchanging values of two variables, summation of a set of numbers, Decimal base to Binary base conversion, Reversing digits of an integer, GCD (Greatest common divisor) of two numbers, Test whether a number is prime, Organize numbers in ascending order, Find square root of a number, factorial computation, Fibonacci sequence, Evaluate "Sin of X" as a sum of a series, Reverse order of elements of an array, Find largest number in an array, Print elements of upper triangular matrix, multiplication of two matrices, Evaluate a polynomial.
3. Simple 'C' concepts: Char set, Variables and Identifiers, Variable declaration and definition, Built-in data types, Arithmetic Operators & Expressions, Logical operators and Relational Operators, Constants, Literals, Basic input/output functions, "Hello World" program.
4. Conditions and iteration : Conditions and Actions, Condition statement, Simple control statement (*if*, *if-else*, *switch*), Iterative control statements (*while*, *do-while*, *for*)
5. Functions: Function syntax, Calling program, called program, Prototype, formal arguments, return type, argument passing type (*by value, by ref*), standard library of C functions.
6. Pointers: Pointer type declaration, Operators, assignment, initialization, pointer arithmetic, function and pointers
7. Arrays: One and Two dimensional arrays: Array declaration, initialization, accessing the values, Pointer arrays, strings and char arrays, arrays and pointers
8. Struct and Union: Variable declaration, storing & accessing elements, arrays, pointers, nesting
9. File: FILE variable, file access modes, copying a file to another, seeking a location
10. Preprocessing: Basic preprocessing statements: #ifdef, #ifndef, #define, #include.

Text Books:

1. R. G. Dromey, How to solve it by computer, Prentice Hall of India.
2. Behrouz Forouzan, Richard Gilberg, Computer Science: A Structure Programming Approach using C, Thomson Learning.

Reference books:

1. Byron Gottfried, Programming with C, Tata McGraw Hill
2. B. W. Kernighan and D. M. Ritchie, The C Programming Language, PHI

Three years B. Sc. Degree Programme
Major: Computer Science
Semester I

Paper I Lab : C Programming (25 marks)

This is to be done in LINUX. An attempt should be made to make them conversant with "make" tool, dividing the program in different.
Assignments must be designed so as to cover all concept listed above in the theory part.
A sample list of assignments is as follows:

1. Write a program to display a message on the console.
2. Write a program to read 4 nos and find the largest and minimum of them.
3. Write a recursive function for finding the Nth Fibonacci term.
4. Write a C program to read the information of 10 students and generate a report of students coming from x place, a report showing the list of all students in ascending order of last name.
5. Copy a file to another location.
6. Read n nos in an array and find out how many of them are prime nos.

Paper II: Mathematical Foundation of Computer Science

Major: Computer Science
Semester I

1. Binary Number System – Decimal to binary conversion and vice versa, binary number representation (signed, 1's complement and 2's complement) binary addition, subtraction, binary to octal, hexadecimal conversion and vice versa. Floating point representation

2. Matrices: Types, matrix arithmetic, transpose and powers, determinants

3. Boolean Algebra: Boolean functions, truth table, DeMorgan's theorem, logic gates, Realization of Boolean function using logic gates, Simplification using Karnaugh map

4. Set Relations and Functions: Venn diagram, set operations, relations and properties, closures, equivlence relations, partial ordering, functions, function types, inverse of functions, composition of functions, recursive functions, recurrence relations, growth of functions

5. Logic: Propositional logic, first order logic, mathematical induction, deduction, proof by contradiction, program correctness

6. Grammars, Languages and Automation: Grammars and languages, finite automation of finite state machines, regular languages, regular expressions

7. Graph Theory: Notations, definitions, types of graph – multigraph, pseudograph, simple, directed, undirected and weighted graph, representation of graph, applications of graph, Dijkstra's algorithm, Tree – notations, traversals, expression tree, binary search tree, balanced tree – left rotation and right rotation

References:

1. Kenneth H. Resen, *Discrete Mathematics and its Applications*, Tata McGraw Hill, fifth edition
2. Narsingh Deo, *Graph Theory with Applications to Engineering and Computer Science*, Prentice Hall of India
3. Swapan Kumar Sarkar, *A Textbook of Discrete Mathematics*, S Chand, third edition

Practical:

Different tags such as <p>, <u>, <big>, <small>, <h1>, <h2>, <font size = 4>, <font color = "red"> <font face = "New Times Roman">, , <pre>, <blockquote>, <address>; Ordered list, unordered list; Tables using border, bgcolor, cellspacing and cellpadding; Working with links, link within a file, link to a program, a website; Design a front page of a hotel by putting images appropriately. Design pages using hspace and vspace alignments; frame; inline and embedded style sheet

References:

1. **J. H. Pence, *How to Do Everything with HTML*, Tata McGraw-Hill, 2001**

2. **E. Freeman, E. Freeman, *Head First HTML with CSS & XHTML*, O'Relly, 2006**
3. **A. Navarro, T. Stauffer, HTML By Example, PHI, 2000**

Paper 3 Data Structures using C

Objective : The objective of the course is to introduce the fundamentals of Data Structures, Abstract concepts and how these concepts are useful in problem solving. This course aims at the student to be able to –

- Understand and use the process of abstraction using a programming language such as 'C'.
- Analyze step by step and develop algorithms to solve real world problems.
- Implement various data structures viz. Stacks, Queues, Linked lists, Trees.
- Understand various techniques of searching and sorting.

Theory Syllabus(75 Marks)

1. Data Structures : Introduction, primitive data types, ADT, 'O' notation and efficiency
2. Composite data types : Implementation of arrays, structures and unions. Index calculation for array(Row major and Column major)
3. Stacks : Definition, operation & representation, Application : infix to postfix conversion, postfix expression evaluation, recursion, efficiency of recursion
4. Queues : Definition, operation & representation. Priority Queues.
5. Linked Lists : Arrays representation. Dynamic variables representation. Comparison of both representation. Circular list, Doubly linked list. Implementation of stacks and queues.

6. Trees : Binary Tree, operations, implementation(Insertion, deletion and traversal methods) and applications. *Multiway trees, *B-tree, *B+ tree.
7. Sorting : Quicksort, Binary tree sort, heap sort, shell sort, merge sort.
8. Searching : Sequential, Index-Sequential, binary search, tree search – Balanced trees. Hashing – Hash function, Collision, Internal and External hashing.
9. Graphs : Introduction, application and representation(Array and linked list). Forest, spanning forest. Shortest path algorithm.
10. Storage Management : Dynamic memory management.

* Description and its applications.

Text Book

1. Y.Langsam, M.Augenstein and A.Tanenbaum. Data structures using C and C++ by Prentice Hall of India, latest edition

FYBSc - Semester II

Paper IV: Computer Organization

Objective: To understand the building blocks of computer and study various design issues. To be able to design, execute and debug assembly language programs.

I. Theory Syllabus(75 marks)

1. COMPUTER SYSTEM: Computer components, Computer functions interconnection structure-CPU, Memory, I/O, Bus interconnection.
2. INTERNAL MEMORY: Characteristics of memory system, the memory hierarchy, semiconductor main memory, Cache memory- principles, elements of cache design, mapping functions, replacement algorithms, write policy, block size.

3. INPUT/OUTPUT: External devices, I/O modules, Programmed I/O, Interrupt driven I/O, DMA, I/O channels and processors.
4. COMPUTER ARITHMETIC: number systems, ALU, integer representation, integer arithmetic, floating-point representation and arithmetic
5. INSTRUCTION SETS: Machine instructions characteristics, Types of operations-data transfer, arithmetic, logical, conversion, I/O, system control, transfer of control; Assembly language, Addressing modes-immediate, direct, indirect, register, register indirect, displacement, stack; Instruction formats- instruction length, allocation of bits, variable length instructions.
6. CPU: Processor organization, register organization, instruction cycle-fetch, execute, interrupt, indirect data flow.
7. CONTROL UNIT: Micro operations, control of CPU-functional requirements, control signals, internal CPU organisation, hardwired implementation.
8. MICROPROGRAMMING: Basic concepts, micro instructions, microprogrammed control unit; microinstruction sequencing- design considerations, sequencing techniques, address generation; microinstruction execution-taxonomy, encoding; applications of microprogramming.
9. Advanced topics: * RISC concepts, superscalar processors, parallel processing.

*- Brief idea only.

TEXT BOOKS

1. William Stallings, Computer Organization and Architecture-Designing for performance (Fourth Edition) by EEE, PHI.

II. PRACTICAL (25 marks)

C programs to perform binary and hexadecimal arithmetic(20%)

Introduction to 8086 architecture and instruction set and Writing assembly language programs in 8086 (80%) using MASM or compatible assembler either in windows or linux.

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Syllabus

Semester III Paper I : Operating Systems : (Theory)

1. Operating Systems Overview: Operating System Objectives and Functions, Evolution, Major Achievements, characteristics of modern operating systems, Traditional and Modern Unix Systems.

2. Processes: Process Description and Control, Process states, process description, process control. Threads, SMP and Microkernels Processes and Threads, Symmetric Multiprocessing, Microkernels.

3. Concurrency : Mutual Exclusion and Synchronization. Principles of Concurrency, Mutual Exclusion: Software approaches, Mutual Exclusion: Hardware support, semaphores, monitors, messages passing, readers/writers problem. Concurrency : Deadlock and Starvation. Principles of Deadlock, Deadlock prevention, avoidance, detection, an integrated deadlock strategy, dining philosophers problem.

4. Memory management: Memory Management requirements, memory partitioning, paging, segmentation. Virtual Memory Hardware and Control Structures, Operating System Software.

5. Scheduling: Uniprocessor Scheduling Types of Scheduling, Scheduling Algorithms Multiprocessor and Real Time Scheduling Multiprocessor Scheduling, Real Time Scheduling.

6. Input/Output and Files I/O Management and Disk Scheduling I/O Devices, Organization of the I/O function, Operating System Design issues, I/O buffering, Disk Scheduling, RAID, Disk Cache.

7. File Management Overview, File Organisation, File Directories, File Sharing, Record Blocking, Secondary Storage Management.

8. Security Security threats, protection, intruders, malicious software, trusted systems.

Textbook

Operating Systems – William Stallings – Fourth Edition, Pearson Education

Reference:

Operating Systems: Silberchatz, Galvin- Fifth Edition, Addison Wesley

Semester III Paper I : Operating Systems : (Practical)

Installing Linux Operating System, Partitioning and formatting disk, installing OS, applications. Installing device drivers, working with files, mounting file systems, checking system space, multimedia, vi editor, creating, modifying and deleting user accounts,.
Shell Programming in Unix/Linux, arithmetic operations, loops, files
Programs to implement Operating system concepts such as :Programs on Readers/Writers problem, simple programs using threads, scheduling algorithms, simulation programs on memory management using variable partitions of variable sizes and one of first-fit, next-fit, or best-fit algorithms
Simple programs on system calls in Linux using C
Case Studies on Unix/Windows covering above concepts.

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Syllabus

Semester III Paper II : DataBase Management System-I (Theory)

1. Introduction to Data Base Systems: File Systems versus a DBMS, The Relational Model, Levels of abstraction in a DBMS, Data independence, Queries in DBMS, Concurrent Access and Crash Recovery, Structure of DBMS, Advantage of DBMS, People who deal with Databases.

2. The Relational Model: Attributes and domains, Relations, Integrity Constraints, Key Constraints, Foreign Key Constraints, General Constraints, Query Languages

3. Relational Algebra and SQL: Selection and Projection, Set Operation, Renaming, Joins, Division. SQL: The Form of Basic SQL query, Condition specification, SQL Join, Union, Intersect, Except, Nested queries-Aggregate Operators, updates, Null values, Embedded SQL, Triggers, Cursors, Dynamic SQL, Data Definition, Introduction to Database Security : views

4. Conceptual design and ER model: Overview of Data Base Design – The ER model-features, Key Constraints, Participation Constraints, weak Entities, Class Hierarchies, Aggregation

Textbook:
Database System Concepts by Silberschatz , Korth , McGraw Hill publication

References:
1. 'DataBase Management Systems' by Raghu Ramakrishnan, McGraw Hill publ.
2. 'An Introduction to Database systems' by Bipin Desai Galgotia Publications

Semester III Paper II : DataBase Management System-I (Practical)

Practicals:
Gathering information, Analysing data, ER Diagram, Reduction to Tables
SQL queries, Study features of a commercial RDBMS such as (Oracle,Ms-Access and SQLserver)
Some Applications are given for reference: Healthcare Information System, Matrimonial Information System, Land Records Information System, University Information System, Road Transport Information System, Personal Accounts-Insurance, Loans etc

SEMESTER IV Paper I : Object Oriented Programming in Java: (Theory)

1. Introduction to Object Oriented Programming, problems with procedure oriented programming, Reusability and Extensibility, abstract data type, Encapsulation, data abstraction and data hiding.
2. Introduction to Java – variables, data types, operators, control structures, arrays, methods, method overloading and method overriding.
3. Object based programming – Introduction, Abstract data types with a class, objects, members, controlling access to members, packages, Interfaces, initializing class objects using constructors, overloaded constructors, finalizers, Set and Get methods, friendly access(package access) composition-objects as instance variables of other classes, using this reference, static class members, Inheritance – superclasses and subclasses, protected members, using constructors and finalizers in subclass, composition v/s inheritance, polymorphism, dynamic method binding, final methods and classes, abstract superclass and concrete class.
4. Exception handling- Try, throw and catch blocks, rethrowing an exception, throws clause, finally block, exception handling in constructors and inheritance.

5. Java Collections
6. Applications using Java: Interfaces, packages, String operations, Multithreading, Designing Abstract data types like stack, JAR creation, persistence, garbage collection.

Textbook:
1. Java – How to Pogram, by Deitel & Deitel, Prentice Hall publication

References:
1.Java Handbook , by Patrick Naughton, Tata McGraw Hill publication
2. Computing Concepts with Java 2 Essentials by Cay Horstmann, Wiley Publications

SEMESTER IV Paper I : Object Oriented Programming in Java (Practical)

List of assignments:
Simple programs covering various features of Java: Various datatypes, Various operations, Control structures, Arrays, Methods
Programs on various concepts of OOP, Simple Class, Controlling access to members Constructors, Composition, Inheritance – superclass, subclass and protected members Polymorphism, Implementation of ADT : Stack, Queue, lists
Exception Handling, collections

SEMESTER IV Paper II : Data Base Management System-II (Theory)

1. Schema Refinement and Normal forms: Introduction, Why Schema Refinement ?, Functional Dependencies, Closure of a set of FDs and Attribute closure, Normal Forms—BCNF, Third Normal Form, Decomposition- Lossless-Join Decomposition, Dependency-Preserving Decomposition, Normalisation-Decomposition into BCNF, Decomposition into 3NF

2. Concurrency Control : The concept of transaction, transaction and schedule, Notion of consistency, Serializability, Lock based concurrency control, concurrency control without locking, deadlocks

3. Crash Recovery: Introduction to crash recovery, Recovery and atomicity, Log based recovery, Shadow paging.

4. Security : Introduction to Database security & Integrity threats, Defense Mechanisms-views, Access control, discretionary access control, mandatory access control, statistical databases, auditing and control

5. SQL3 Object relational features

6. Object Oriented databases: Object oriented data model-Object structure, object classes, Inheritance, multiple inheritances, object identity, Object containment.

7. Introduction to Distributed Databases, data mining, data warehousing

Textbook:
1. Database System Concepts, by Silberschatz , Korth , McGraw Hill publication

References:
1. 'DataBase Management Systems' by Raghu Ramakrishnan, McGraw Hill publ.
2. 'An Introduction to Database Systems' by Bipin Desai, Galgotia Publications

SEMESTER IV Paper II : Data Base Management System-II (Practical)
Using RDBMS and front-end like VB
List of Practical:
Normalisation,
Creating forms for data entry
Reports

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SEMESTER V

Paper I : Software Engineering-I

1. Software process. Characteristics of software process.(chap 2.1, 2.2 – Jalote) **(4L)**

2. Software development processes and methodologies: waterfall, prototyping, iterative, spiral, (chap 2 – Jalote)

unified process, Benefits of iterative and

incremental approach with emphasis on Unified process. ,-(chap 2.1- Larman)

agile methodologies.(Assignments – chap 2 – Fowler) **(6L)**

3. OOAD: Assigning responsibilities. What is analysis and Design? What is OOAD?

(chap 1 – Larman) (3**L)**

4. UML: Introduction. Brief review of OO concepts. Main UML diagrams- class diagram, sequence diagram, activity diagram, use case diagram.

(chap 1 – Fowler) **(5L)**

5. Requirements : use case model- use case diagram, use case descriptions, use case realization using sequence and activity diagrams. Supplementary requirements. Advanced use case model features.(chap 6 – Larmer)

Requirements: Functional and non-functional - user – system –requirement engineering process– requirements –: elicitation, analysis, specification, verification and management.(Techniques such as Interveiwing, Requirment workshop, brainstorming, prototyping). Vision document . Characteristics of SRS.(chap 7,8,9 – Larmer)

(10L)

6. Domain(conceptual model) model- concepts, attributes, operations. (chap 10,11,12-Larmer) **(3L)**

7. CRC technique(chap 4-Fowler) and elementary GRASP patterns.(chap 16 – Larman)

(6L)

8. Design Model: design class diagram, sequence diagram, activity diagram, state chart diagram, deployment diagram. Advanced GRASP patterns. (chap 17,18,19,22 – Larmer)

(6L)

9. Brief introduction to other UML 2.0 diagrams. 13 UML diagrams to be introduced-no need to know how to draw) (chap 1- Fowler)

(2L)

Text Books:

1. Craig Larman, Applying UML and patterns, 2nd Edition, Addison Wesley, 2003.
2. Martin Fowler, UML Distilled, 2nd Edition, Addison Wesley, 2003

References:

1. Grady Booch, James Rumbaugh, Ivar Jacobson, The Unified Modeling Language User Guide, Addison – Wesley Longman, 1999, ISBN 0-201-57 168 –4.
2. Rebecca Wirfs Brook, Designing Object Oriented Software, PHI
   Managing Software Requirements, Dean Leffingwell, Pearson Education.
3. Object Oriented Systems Analysis and Design Using UML by Simon Bennett, Steve McRob and Ray Farmer. Tata Mc.Graw Hill.
4. An Integrated Approach to Software Engineering by Pankaj Jalote. Narosa Publishing House, 2nd edition.
5. Software Engineering-A Practioner's Approach by Pressman. 6th Edition. Tata McGraw Hill.

SEMESTER V

Paper II: Computer Networks-I

1. Introduction: Use of computer Networks, Business Applications, Home Applications, Mobile Users. Network Hardware, Local Area Networks, Metropolitan Area Network, Wide Area Network, Network Software, Protocol Hierarchies, Design Issues for the Layers, Connection oriented and Connectionless Services. Reference Models, OSI Reference Model, TCP/IP Reference Model, A Comparison of OSI & TCP Ref. Models. Architecture of Internet. **(6L)**

2. Physical Layer: Transmission Media, Twisted pair, Coaxial Cable, Fiber Optics (multi-mode and single-mode fiber, fiber cables, comparison of semi conductor LASERs and LEDs as light sources, comparison of fiber optic and copper wire. Public Switched Telephone Network, Structure of Telephone System, The Local Loop: Trunks & Multiplexing (FDM,TDM,WDM). Switching, Modems(only)

(8L)

3. Data Link Layer: Data Link Layer Design Issues, Services provided to the network layer, Framing, Error control, Flow control. Elementary Data Link Protocols (no details of pseudocode), Unrestricted Simplex protocol, A Simplex stop and wait protocol, A Simplex protocol with Noisy channel, Sliding Window Protocol, One bit sliding window protocol, Examples Data Link Protocols, HDLC – High-Level Data Link Control, Data Link Layer in the Internet.

(9L)

4. Medium Access Sublayer, Multiple Access Protocols, ALOHA (no details of probability equations), CSMA Protocols, Collision-Free Protocols (Bit Map protocol, Binary countdown), Ethernet: Ethernet Cabling, Manchester Encoding, The Ethernet MAC sublayer protocol, The Binary exponential backoff algorithm, Switched Ethernet, Fast Ethernet, Gigabit Ethernet(introduction), IEEE 802.2 : Logical Link Control, Data Link Layer Switching, Network devices (introduction): Repeaters, Hubs, Bridges, Switches. **(10L)**

5. Network Layer, Network Layer Design Issues, Store-and-Forward Packet Switching, Services provided to Transport Layer, Implementation of Connectionless Service, Implementation of Connection-Oriented Service, Comparison of Virtual-Circuit and Datagram Subnets, Routing Algorithms, Shortest Path Routing, Flooding, Distance Vector routing, Hierarchical routing, Congestion Control,General principles of Congestion control, Congestion prevention policies. The Network Layer in The Internet, Protocol, IP Addresses (IP address formats). **(10L)**

6.Introduction to Wireless Networks **(2L)**

Text Book :

Tanenbaum A, Computer Networks (4th Edition) PHI, India.

References :

- Ulyess Black. Computer Networks, Protocols, Standards and Interfaces (2nd Edition) PHI, India.
- ED Tittel. Computer Networking, Schaum's Outlines, Tata McGraw-Hill

- Behroz A Forouzan Data Communication and networkin , Tata McGraw-Hill

SEMESTER V

Paper III: Web Technology

1. **Web Technologies:** Introduction to Web technology, Web pages and Browsing, Dynamic Web Pages, Java script, Dynamic web document technologies - JSP, ASP, Active web pages and Active Web technologies. **(3L)**
2. **Applets:** Definition, uses, life cycle, state transition diagram, interactive applets. **(3L)**
3. **Java Server Pages(JSP):** Introduction, JSP overview, JSP environment, Expressions, Declarations, scriptlets, Simple javabeans in JSP- introduction , Custom Tag Libraries , JSP standard tag library, Processing input and Output, database connectivity using JDBC-ODBC. **(15L)**

4. **Servlets :** Introduction to servlets, Servlet lifecycle, Servlet classes, Threading models – introduction. **(5L)**

5. Extensible Markup Language (XML): History of XML, XML Basics, syntax, XML Schemas, Document Type Definitions(DTD), XML Namespaces, DOM (Document Object Model), XSL(Extensible Style Sheet Language) **(12L)**

Using JSP to generate an XML document, Generating XML from database, using XSL to format XML **(3L)**

6.Ajax – request object creation, forwarding the request, accepting response object and display on webpage **(2L)**

7. Introduction to **Ruby on Rails,** Microsoft ASP .NET (**2L)**

Text Books

- Achyut S Godbole and Atul Kahate, “Web Technologies, Tat McGraw-Hill
- Java Server Pages- fast and easy web development by Aneesha Bakharia, Prentice Hall Publ
- Douglas E. Comer, “Computer Networks and Internet”, Pearson Education Asia.
- Respective web sites to be referred

Reference Books

- ‘The Complete Reference JSP2.0’, by Phil Hanna, Tata Mcgraw Hill
- ‘Java Server Pages’ by Hans Bergsten, O’Reilly
- Web reference: http: // java .sun.com.
- H M Dietel and A B Goldberg, ‘ Internet and World Wide Web: How to Program”, Pearson Education.
- Douglas E. Comer, “The Internet”, Pearson Education Asia.
- Daniel Minoli, “Internet & Intranet Engineering: technologies, protocol, and Application”, Tata McGraw-Hill.
- Raj Kamal, “Internet and Web Technologies” Tata McGraw-Hill
- Margaret Levine Young, “ The Complete Reference Internet”, , Tat McGraw-Hill.

SEMESTER V

Paper IV : Microcontroller Architecture and Programming

1. Introduction: **(3L)**
   Microprocessors and Microntrollers, Microcontroller survey

2. 8051 Architecture: **(8L)**
   Hardware, Input/Output pins, Ports and Circuits, Memories, Counters & Timers, Serial data Input/ Output, Interrupts.

3. 8051 Instruction Set: **(9L)**
   Addressing modes, Data movement instruction–external data move, Code memory read-only-data moves, Push and Pop opcodes, data exchanges, Programs.
   Jump instructions, Call and Return instructions, Programs.

4. Logical Operations: **(3L)**

Bit and byte level, rotate and swap.

5. Arithmetic Operations: **(7L)**
   Flags, Incrementing, decrementing, addition, subtraction, multiplication and division, decimal arithmetic, Programs.

6. Interrupt Programming: **(5L)**
   8051 interrupts, Programming-Timer interrupts, External hardware interrupts. Interrupt Priority in 8051.

7. Interfacing 8051 & Programming: **(8L)**
   LED, 7-Segment display, LCD, Keyboard, Stepper motor (including working principles), DAC & ADC.

8. Embedded software development tools: **(3L)**
   Features of embedded systems, Integrated Development Environments (IDE) for 8051 systems, Simulators, Debuggers, Compilers, Cross compilers, Software monitors, Watch dog timers.

Text books:

- Kenneth J Ayala - The 8051 Microcontroller, architecture, programming & applications. Second edition – Penram international.
- Muhammad Ali Mazidi & Janice Mazidi - The 8051 microcontroller and Embedded systems – Pearson Education.

Reference Books:

- David Simon - An Embedded Software Primer – Pearson Education
- Myke Predco - Programming and customizing 8051 microcontroller.

SEMESTER V

Paper V : UML & Web Technology Labs

Group A: UML Assignments and miniproject: Use of Rational Studio (Rose) to draw UML diagrams such as Use Case Diagram, Class Diagram, Sequence diagram, Activity diagram with and without swimlanes, statechart Diagram, Deployment diagram, component diagram. Optional: Use of Requirement management tool such as RequisitePro. Creation of documentation such as SRS, SDS from UML diagrams. Generation of code from UML model.

List:

1) Introduction to basic tools(StarUML, Agro UML, Rational Studio)
2) Basic Features of Class Diagram(identify and add:- class, association, attributes & operations)
3) Advance Features of Class diagram using inheritance
4) Advance features of Class diagram using aggregation, composition, role name, visibility, navigability, interfaces, abstract classes
5) Use case diagram
6) Sequence diagram
7) Activity diagram
8) Analysis / Domain Model
9) Design Level class diagram
10) State diagram
11) Deployment diagram
12) Other UML-2.0 diagram and source code generation

These exercises may be completed by assigning a miniproject.

Group B: Web technology Assignments and miniproject: Assignments demonstrating use of Javascript, Applet, JSP, Servlet, JDBC, XML and a miniproject using some of these technologies.

Miniproject – To design web sites implementing client and server side features using relevant technologies.

Note:
It is recommended that the mini project to be assigned for both the components of Paper V(UML & Web Tech.) has to be same.

SEMESTER V

Paper VI : Computer Network & Microcontroller Labs

Group A : Networking Lab

1. Configuring TCP/IP on a desktop,(use of command ipconfig)
2. Using diagnostic Network Commands : ping, traceroute, netstat, nslookup
3. Simulation of framing using Bit stuffing and character stuffing.
4. Simulation of stop and wait protocol.
5. Setting up of wireless network (ad-hoc and Infrastructure)
6. Use of route command.
7. Configuring a modem for Internet connectivity.
8. Implementation of shortest path algorithm.
9. IP address manipulation (Extract network id and Host id given netmask)
10. Simulating IP fragmentation and reassembly.

Group B : Microcontroller Programming Lab

Practical should be conducted using development boards or Simulators (like UMPS, Keil, etc.,) using assembly language for 8051.

Students should also be exposed to write programs for 8051 using C language.

8051 Programming: (Assembly Language Program and C)

1. Programs to illustrate various addressing modes of 8051.
2. Programs to perform all the logical operations.
3. Programs to perform arithmetic operations (including BCD addition) with data in internal/external RAMs and use of Register Banks.
4. Programs to illustrate loop, jump and call instructions.
5. Programs to perform single bit operations (bit addressable RAM, I/O Ports).
6. Programs to illustrate 8051 Timer in mode 1 & mode 2 and Counters.
7. Programs to illustrate Timer Interrupts and External Interrupts.
8. Interface LCD to 8051 and display messages.
9. Interface Keypad to 8051 and program to accept the key input and display it on LCD.
10. Interface LEDs and 7-segment displays to 8051 and program to activate the devices.
11. Program to demonstrate Traffic Light Signals.

12. Programs using Digital to Analog (DAC) and Analog to Digital Convertors (ADC).
13. Programs to demonstrate serial communication and serial interface like I^2C.

Note: Programs from 6 to 13 could be written in both ALP & C.

Reference Books for Practicals:

1. 8051 microcontroller and embedded systems –Using Assembly and C – Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay – Pearson Education.
2. Myke Predco - Programming and customizing 8051 microcontroller.

Semester VI

Paper I : Software Engineering-II

1. Human Computer Interaction: What is HCI? User categories, Interface Design- Internal & External Interface design, user interface design
   Interface design guidelines. (chap 15 – Pressman)
   (3L)

2. Coding styles, standards, peer reviews, checklist, (chap 8 – Jalote)
   Refactoring. (chap 1 –Improving the design of existing code by Martin Fowler) / (Code complete by Steve) **(4L)**

3. Testing: Testing Fundamental, Functional Testing, Structural Testing, Testing Object-Oriented Programs, Testing Process and Metrics. (chap 9 – Jalote) **(11L)**

4. PEOPLE AND ORGANIZATIONAL ISSUES IN TESTING: Common people issues and myths in testing, Providing career paths in testing, Organizational structures for testing teams, Geographically distributed testing teams and success factors.(Text Book 1 by Srinivasan) **(5L)**

5. Importance of documentation -- Need for Software Documentation - – different types of documentation -- Understanding task orientation - Analyzing users - Writing user scenarios - User informational needs - Document goals - User work motivations - User analysis checklist - Constructing a task list - Categorization - Writing steps as actions - Task analysis.(chap 31 – Pressman (6^{th} Edition)
   (5L)

6. Reengineering: Business Process Reengineering, Software Reengineering, Reverse Engineering, Restructuring, Forward Engineering, The Economics of Reengineering (chap 4 – Jalote) **(6L)**

7. Project Management: Planning a Software Project –Cost estimation, Project Scheduling, Software configuration management plans, Quality Assurance plans, Project Monitoring plans and Risk Management. **(11L)**

Text Books:

1. Srinivasan Desikan and Gopalaswamy Ramesh, Software Testing – Principles and Practices, Pearson Education, 2006
2. Integrated Approach to Software Engineering ,3rd Edition, Pankaj Jalote, Narosa Edition, 2006.

Reference Books

1. Glenford J.Myers, " The Art of Software Testing ", John Wiley & Sons, 1979.
   Boris Beizer, Black-Box Testing: " Techniques for Functional Testing of Software and Systems ",John Wiley & Sons, 1995.
2. P.C.Jorgensen, " Software Testing – A Craftman's Approach ", CRC Press, 1995.
3. William E.Perry, " Effective Methods for Software Testing (2nd Edition) ", John Wiley & Sons, 2000.
4. Robert V.Binder, " Testing Object-Oriented Systems: Models Patterns and Tools", Addison Wesley, 2000.
5. Boris Beizer, " Software Testing Techniques (2nd Edition) ", Van Nostrand Reinhold, 1990.
6. Thomas T. Barker , "Writing s/w documentation - a task oriented approach", Allyn & Bacon Series of Technical Communication , 1998.
7. Edmond H.Weiss, How To Write Usable User Documentation : Second Edition , Oryx Press; 2nd edition 1991.
8. Huckin, et al, " Technical Writing and Professional Communication ", McGraw Hill, 1991.
9. IEEE Standards on Documentation
11. Designing the User Interfaces, Ben Shneidermann, Addison Wesley, 1998
12. Code Complete by Steve Mc Conell
13. An Integrated Approach to Software Engineering by Pankaj Jalote. Narosa Publishing House, 2nd edition
14. Software Engineering-A Practioner's Approach by Pressman. 6th Edition. Tata McGraw Hill.

SEMESTER VI

Paper II : Computer Networks II

1.Internet Control Protocols (ICMP,ARP, RARP), IP subnets. Introduction to Routers and Gateways. What is DHCP. **(9L)**

2. Transport Layer, Transport Services, Services provided to upper layer, Transport service primitives, Berkeley Sockets, Internet Transport Protocols, UDP, Introduction to UDP, Remote Procedure Call, Internet Transport Protocols : TCP, Introduction to TCP, TCP Services Model, TCP Protocol, TCP Segment Header, TCP Connection Establishment, TCP Connection Release, Modeling TCP Connection Management, TCP Transmission Policy. **(16L)**

3.. Application Layer, DNS – Domain Name System, DNS Name Space, DNS Resource Record, Name Servers, Electronic Mail, Architecture & services, User Agent, Message

Transfer, Final Delivery, WWW, Architectural Overview.
(8L)

4. Network Security: Need for security, principles of security, Types of attack (1.5.1 &1.5.2), Cryptographic techniques: Introduction to Cryptography, Plain text and cipher text, Substitution techniques, Transposition techniques, Encryption and Decryption, Symmetric and asymmetric key cryptography, Public Key Infrastructure: Digital certificates, Firewalls. **(12L)**

Text Books:

1. Tanenbaum A. Computer Networks (4^{th} Edition) PHI, India.

2. Atul Kahate. Cryptography and Network Security, Tata McGraw-Hill (for 3^{rd} Chapter).

References :

- Ulyess Black. Computer Networks, Protocols, Standards and Interfaces (2^{nd} Edition) PHI, India.
- Behroz A Forouzan Data Communication and networkin **,** Tata McGraw-Hill

Semester VI

Paper III : Simulation and Modeling

1. System models and System studies: Concept of a system, Systems ---- Continuous/discrete, deterministic/stochastic, open/closed Classification of mathematical models ----- static/dynamic, linear/nonlinear, deterministic/stochastic. Principles used in modeling, System studies-interacting subsystems and examples, System design and analysis. **(3L)**

2. Defining Simulation and its appropriateness, Advantages and disadvantages of simulation, Areas of application, Continuous system simulation, Model formulation through differential equations **(4L)**

3. Concepts in Discrete-Event Simulation. Steps in simulation study. The Event-Scheduling/Time-Advance Algorithm, Simulation using Event Scheduling, List processing. **(3L)**

4. (a) Random-Number Generation, Properties of Random numbers, Generation of Pseudo-Random Numbers, Combined Linear Congruential Generators, Test for Randomness.

   (b) Algorithms for generation of discrete random numbers -- binomial, geometric, poisson distributions

   (c) Continuous Random-Variate Generation. Inverse Transform technique—

   Exponential distribution, Uniform distribution, Direct Transformation for

   the Normal Distribution, Rejection Method

   (d) Monte Carlo Method: Evaluation of Integral - Hit or Miss method, Evaluation of π **(12L)**

5. Queuing Models: Characteristics of Queuing systems, Queuing notation, Long-Run measures of performance of queueing systems, Steady-State Behavior of Infinite-Population Markovian Models-M/M/1, M/M/c. **(8L)**

6. Simulation Examples: Simulation of queuing system, Simulation of Inventory Control. **(6L)**

7. Simulation Software: Selection of simulation software, Introduction to GPSS: usage of block statements and control statements. **(10L)**

8. Verification and Validation of Simulation Models. Model Building-Verification and validation, verification of simulation models, Calibration and validation of models: Face validity, Validation of model assumptions, Input-Output validation. **(2L)**

Text Books:

1. Geoffrey Gordon, "System Simulation", 2nd Edition, Prentice-Hall, India, 2002.
2. Narsingh Deo, "System Simulation with Digital Computer", Prentice-Hall, India.
3. Fred J. Maryansky, "Digital Computer Simulation", C. B. S. Publishers and Distributors.

SEMESTER VI

Paper IV: Modern Development Frameworks

1. Design Patterns**:** Introduction, Why to use design patterns, common design patterns – Singleton, Factory, adapter, proxy, observer, composite, Façade, Iterator. **(6L)**

2. Architectural patterns- Layered, Pipe & Filter, MVC. **(5L)**

3. Introduction to .net architecture and application development, Introducing .NET-Characterize the .NET Paradigm, Building .NET-The Framework Components, Common Language Runtime (CLR), Use of .NET Windows Forms, Web Forms, Console Applications. Managing .NET-The Common Language Runtime Components. Identify the Components of the CLR ,Microsoft Intermediate Language (MSIL) ,.NET Compilers ,Memory management with CLR . Advantage of the Common Language Runtime – Re-Use code, multiple language support, Cross-Language Interoperability , Garbage Collection, Error-Handling. Unifying .NET-The Class Framework - Purpose of Namespaces , To Use or Not to Use Inheritance, OOP in .NET (Abstraction, Polymorphism, Inheritance, Encapsulation, members, methods and properties).
(23L)

4. SOA and Web Services: SOA Definition & Concepts: Concept of Service in an SOA context, SOA abstraction & granularity levels, Operational Transactions, Business Processes. Web Services: Components, Component Coupling: Tightly-coupled vs. Loosely-coupled, Web services and XML. Introduction to Web Services Protocols – SOAP, UDDI, WSDL. **(9L)**

5. Introduction to : Enterprise systems and applications: n-tier applications. Introduction to J2EE, J2EE Architecture. **(3L)**

Reference Books:

1. Design Patterns, Erich Gamma, Richard Helm, Ralph Johnosn , John Vlissides, LPE, Pearson Education.
2. Understanding Web Services: XML, WSDL, SOAP, and UDDI, Eric Newcomer, Addison-Wesley Professional, 2002
3. Web Services Essentials: Distributed Application with XML – RPC, SOAP, UDDI & WSDL, Ethan Cerami, O' Reilly.
4. Service-Oriented Architecture : A Field Guide to Integrating XML and Web Services, Thomas Erl, Prentice Hall, 2004
5. XML Bible, Elliotte Rusty Harold, 3rd Edition, John Wiley & Sons , 2004.
6. Java and XML, Brett Mc Laughlin 2 nd Edition, O'Reilly,2001
7. .NET book –- Microsoft press- (pearson publ) – tools book

SEMESTER VI

Paper V : Case Tools & Modern Development Framework Labs

Group A : CASE Tools Lab

Assignments on the use of following tools preferably using Rational Studio(ROSE).

1. Unit testing with Junit
2. Ant Build Tool
3. Refactoring
4. Source control and version control tools such as CVS/ clearcase/Sourcesafe
5. Project management software
6. Generating documentation using Javadoc

List:

1) Introduction to Junit using Eclispe or Netbeans IDE
   Creating a test case for class
2) Use of test suite for Junit
3) Refactoring – using all options of refactoring menu of Eclispe or Netbeans IDE
4) using all options of source menu of Eclispe or Netbeans IDE.
5) Ant build tool using Eclispe/ Netbeans
6) Source control and Version control (check in and check out code)
   Creating new version of project
7) Project management (MS- project)
8) Project Management (Gantt chart, schedule)
9) Software estimation (use of COCOMO model)
10) Generation of documentation using Java.

Assignments on designing with the help of design patterns
These exercises may be completed by assigning a mini project.

Practical Reference Book :

Java Power Tools - (SPD Shott Publisher)

Group B : Modern Development Framework Lab using .NET

Development using MVC based frameworks
Assignments on VB .NET / C#, (Windows Forms, web services in .NET)

SEMESTER VI

Paper VI : Simulation & Network Programming Labs

Group A : Simulation Lab

Use of Simulation packages, representing and solving problems using Queuing models in spreadsheets.

Practicals: Use of Programming Languages and spreadsheet for simulation of queuing system, inventory system.

1. Generation of various discrete random numbers (variables) and problems/ applications involving their generation and its face validity (03 sessions)
2. Generation of various continuous random numbers (variables) and problems/ applications involving their generation and its face validity (03 sessions)
3. Problems on spreadsheet (03 sessions)
4. Problems involving GPSS (03 sessions)

Group B : Network Programming Lab

1. Setting up of Firewall on Windows Desktop.
2. Use of nmap command for detecting remote services.
3. Simple TCP server to echo back strings sent from Telnet client.
4. Simple TCP client to send strings to above TCP server.

5. Concurrent TCP server for the above client.
6. UDP server/Client.
7. Using gethostbyname function.(fetch a page from any website and print)
8. Setting up DHCP server.
9. Implementing polyalphabetic substitution cipher.
10. Creating a self-signed Digital Certificate by using openSSL utility.

Project:

Students of TY are required to undergo for a project work at their VI-th semester. The projects consists of application of theories and practicals learned in different semesters.

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