The New College (Autonomous), Chennai -14

M.Sc(I.T) Degree Course Structure

CBCS Pattern

(Effective from the year 2011 -2012)

Course Component	Title of Paper	Credits	Total Teaching Hours		Exam Duration	Continuous Assessment	End Semester	Maximum Mars
			Lecture Hours	Practical Hours				
SEMESTER - I								
Core-1	Principles of Programming Languages	4	4		3 Hrs	25	75	100
Core-2	Data Structure and Algorithm	4	4		3 Hrs	25	75	100
Core-3	Unix and Shell Programming	4	4		3 Hrs	25	75	100
Core-4	Lab 1: Unix and shell Programming	3		4	3 Hrs	25	75	100
Core-5	Lab 2: Principles of Programming Languages	3		4	3 Hrs	25	75	100
Elective-1		3	4		3 Hrs	25	75	100
Elective-2		3	4		3 Hrs	25	75	100
Soft Skills-1	Soft Skills for Carrier Prospects – Paper I		1					
Value Education-1			1					
SEMESTER – II								
Core-6	Relational Database Management System	4	4		3 Hrs	25	75	100
Core-7	Visual Programming in .Net	4	4		3 Hrs	25	75	100
Core-8	Java Programming	4	4		3 Hrs	25	75	100
Core-9	Lab 3: Programming in Java	3		4	3 Hrs	25	75	100
Core-10	Lab 4: VB.Net and RDBMS	3		4	3 Hrs	25	75	100
Elective-3		3	4		3 Hrs	25	75	100
ED-1	Essential Language Communication	2	4		3 Hrs	25	75	100
Soft Skills-2	Soft skills for Carrier Prospects – Paper II	2	2		3Hrs	25	75	100
SEMESTER – III								
Core-11	Advanced Java	4	4		3 Hrs	25	75	100
Core-12	Web Technology	4	4		3 Hrs	25	75	100
Core-13	Data Communication Networks	4	4		3 Hrs	25	75	100
Core-14	Lab 5: Java and Web Application	3		4	3 Hrs	25	75	100
Elective-4		3	4		3 Hrs	25	75	100
Elective-5		3	4		3 Hrs	25	75	100
ED-2	Spoken English	2	4		3 Hrs	25	75	100
Value Education-1		1	1			25	75	100
Soft Skills-3	Soft Skills for Carrier Prospects – Paper III	1	1			25	75	100
SEMESTER – IV								
Soft Skills-4	Soft Skills for Carrier Prospects – Paper IV	2	2		3 Hrs	25	75	100
Project		14		14	3 Hrs	50	150	200
GRAND TOTAL		**90**	**72**	**34**	**72**	**675**	**2025**	**2700**

List of Electives

Course Component	Title of Paper	Credits	Total Teaching Hours		Exam Duration	Continuous Assessment	End Semester	Maximum Mars
			Lecture Hours	Practical Hours				
Elective-1	Digital Fundamentals and Computer Architecture	3	4		3 Hrs	25	75	100
Elective-2	Operation Research	3	4		3 Hrs	25	75	100
Elective-3	Neural Networks	3	4		3 Hrs	25	75	100
Elective-4	Artificial Intelligence and Expert Systems	3	4		3 Hrs	25	75	100
Elective-5	Object Oriented Analysis and Design	3	4		3 Hrs	25	75	100
Elective-6	Software Testing	3	4		3 Hrs	25	75	100
Elective-7	Data Warehouse and Data Mining	3	4		3 Hrs	25	75	100
Elective-8	Distributed Operating system	3	4		3 Hrs	25	75	100
Elective-9	Mobile Computing	3	4		3 Hrs	25	75	100
Elective-10	Distributed Database	3	4		3 Hrs	25	75	100
Elective-11	Multimedia	3	4		3 Hrs	25	75	100
Elective-12	Digital Image Processing	3	4		3 Hrs	25	75	100
Elective-13	Advance Computer Architecture	3	4		3 Hrs	25	75	100
Elective-14	Parallel Computing	3	4		3 Hrs	25	75	100
Elective-15	Networks Security and Cryptography	3	4		3 Hrs	25	75	100
Elective-16	E-Commerce	3	4		3 Hrs	25	75	100

CORE 1 : Principles of Programming Languages

Subject Code :

Duration : 3 Hours Max Marks : 100

Unit-I

Stages of development (computer software)-Introduction to programming-programming techniques-Procedure programming-Object oriented programming-Algorothms and flowcharts-Introduction to object oriented programming-Bbenefits and Applications.

Unit-II

Fundamentals of C language-Tokens-Constants-Variables-Operators and Expressions-Formatted Input/Output Function,Character Input/Output functions-Controls structures in C-Loop Control structures -While-Do..While,For..loop,,goto,break,continue statements

Unit-III

Arrays and Subscript variables-Array Declarations-String handling in C-uses of function-User defined function-funciton Declaration-Calling a function-Storage Classes in C-Structures,pointers

Unit-IV

Basic concepts of OOPS-Simple C++ program-Keywords in C++ program-Function overloading-Classes and Objects-Static data member-Static member function-Constructor-Types-Destructor-Operator overloading-Inheritance-Types,Virtual functions,C++ streams and Stream classes

Unit-V

Files-classes for file stream operation-opening and closing a file-detecting end of file-file pointer and their manipulation-error handling-command line arguments.Exception handlling-Try..Throw..catch statements,Templates-class templates and function templates.

TextBook for study

1. H.Schildt, C The complete reference, 4th edition TMH edition,2000.
2. H.Schildt, Complete reference C++

Reference Books for study

1. Byron Gottfried, Programminng with C. 2nd edition, TMH edition,2000.
2. Programming With C-T.Jeyapoovan-Vikas publiction
3. Object oriented programming With C++-E.Balagurusamy Tata McGraw Hill Third Edition

CORE 2 : Data Structures and Algorithms

Subject Code :

Duration : 3 Hours Max Marks : 100

Unit – I

Introduction: Data structures – Operations – Arrays: Rerprsentation – Traversing, Inserting Deleting – Sorting and Searching – Multidimensional arrays.

Unit – II

Stacks – Array reprsentation – Operations – Quick sort, an application of stacks – Recursion – Queues – Linked reprsentation of queues – Operations.

Unit – III

Linked Lists – Reprsentation – Garbage collection – Insertion and deletion from a linked list – Two- way lists.

Unit – IV

Trees: Binary trees – Reprsentation - Traversing binary trees – Heap – Heap sort. Graphs: Graph theory terminology – Sequential reprsentation of Graphs, Adjacency Matrix, Path matrix – Traversing a graph – Hashing – Hash functions.

Unit – V

Algorithm: Definition – Specification – Performance analysis: Space complexity, Time complexity and asymptotic notations.Divide and conquer: General method – Binary search – Merge sort – Greedy method: General method – Knapsack problem – Minimum cost spanning trees – Single source shortest paths – Bactracking: General method – The 8 – Queens problem.

Text Books:

1. Data structures by Seymour Lipschutz, Schaum's outlines – The McGraw- Hill companies.
2. Fundamentals of Computer Algorithms by Ellis Horowitz, Sartaj sahni, Sanguthevar Rajasekaran, Galgotia.

Reference Book:

1. Data structures and Algorithms by G A V PAI, The Tata McGraw – Hill companies.

CORE 3 : Unix and Shell Programming

Subject Code :

Duration : 3 Hours Max Marks : 100

Unit-I

Introduction:What is an Operating System?-Operating System as an Extended Machine-Operating System as a Resource Manager-Operating System Concepts: Processes-Deadlock-Memory Management-Input/Output-files-Security-The Shell

Unit-II

Unix:How the Unix system differs from others OS-Structure of the Unix system-Unix Components-Basic commands in unix-File system-Types of files-File and Directory commands-File attributes and permission-Standard I/O –Redirection-Pipes and Filters

Unit-III

Vi Editor:Text processing commands-Configuring the Vi environment-Process and signal commands..

Unit-IV

Unix- Tools:grep command-Regular expressions-sed command-awk command-sort command-pipelines-wc,cut,uniq,join,pre,tee,tail and tr commands.

Unit-V

Bourne shell programming:Creating shell scripts-case statement-logical operators-shell variables-for loop-while loop-true and false commands-until loop-break and continue statements-if statement-else and elif commands-Sub routines.

Main Reading

1. "Modern Operating Systems" – Andrew S. Tanenbaum 2nd edition, Prentice Hall, 2005
2. M.G.Venkateshmurthy,2005, Introduction to Unix & Shell Programming, Pearson Education India, Delhi.

Reference Books

1. "Introducing UNIX System V"-Rachel Morgan, McGraw-Hill
2. "A User Guide to the UNIX System"- Rebecca Thomas, 2nd edition, McGraw-Hill

CORE 4 : Lab 1 – Unix and Shell Programming

Subject Code :

Duration : 3 Hours Max Marks : 100

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1. Basic Commands in unix(Echo, Who, Date, Cal, Cat, spell, banner, man).
2. File Commands in unix.
3. Directory Commands in unix.
4. Grep, egrep, fgrep, awk, sort commands
5. Wc, cut, uniq, join, pr, tee, tail, tr commands
6. Write a Shell script for Case Construct.
7. Write a Shell script using control constructs
8. Write a Script program to find the number of characters, words and print in reverse order.
9. Write a Script program to find minimum of two given numbers.
10. Write a Script program to find the average of numbers using function
11. Write a Script program to find area of triangle.
12. Write a Script program convert Fahrenheit to degree Celsius.
13. Write a Script program to calculate gross salary of an employee

CORE 5 : Lab 2 – Principles of Programming Language

Subject Code :

Duration : 3 Hours Max Marks : 100

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1. Write a C program to convert from fahreinheit to celcius.
2. Write a C program to display the following output using for loops;

```
1
22
333
4444
55555
```

3. Write a C program to find Sin(X) compare with built- in- function.
4. Write a C program to find volume of cube, cylinder and rectangular box using function overloading.
5. Write a C++ program to find area and perimeter of circle and square using Class.
6. Write a C++ program to count the number of object created using static member function.
7. Write a C++Program to find mean of 'N' numbers using friend function.
8. Write a C++Program to add two times in hours and minutes format using objects as function arguments.
9. Write a C++ program to add two complex number using Overloaded Constructors.
10. Write a C++Program to concatenate strings using dynamic constructors.
11. Write a C++ program to add two complex number using binary operator overloading.
12. Write a C++ program to display students marks using multilevel inheritance.
13. Write a C++ program to multiply two numbers using multiple inheritance.
14. Write a C++ program to display student mark details using virutual base class.
15. Write a C++ program to compare ages of two object using this pointer.
16. Write a C++ program to achieve runtime polymorphism.
17. Write a C++ program to find square root of number using formatted function.
18. Write a C++ program to read a text file.
19. Write a C++ program to read and write a class object.
20. Write a C++ program to generate exception for dividing number by zero.

CORE 6 : Relational Database Management System

Subject Code :

Duration : 3 Hours Max Marks : 100

Unit I

Database concepts –E-R-model-Basic concepts-Constraints-Keys-E-R-Diagram-Reduction of E-R Schema-UML-Design of an E-R database Schema-Relational model-Relational Algebra—View-Tuple relational calculus-Domain relational calculus-Relational database-SQL-Basic structure-Set Quotation-Sub queries-join relation-DDL-DML-Embedded SQL,QBE.

Unit II

Integrity & Security-Domain constraints-Referetional integrity-triggers-Authorization in SQL-Relational database design-1st,2nd,3rd,4th,BCNF normal forms-decomposition.

Unit III

Object relational data model-nested relation-complex types-Inheritances-reference types-Querying with complex types-functions & Procedures-object oriented verses Object relational-Introduction to XML concepts-Storage and file structure-Physical storage media-File organization storage, storage for Object Oriented Databases, Organization of records in files

Unit IV

Indexing and Hashing-basic concepts-Static Hashing-Dynamic- Multiple key access-Query processing-Selection operation-Sorting-Join operation transaction –state Atomicity & amiability-serializability-Transaction Definition in SQL-Concurrency control-Protocols-Deadlock handling

Unit V

Database system architecture-Centralized & Client server architecture-Server system

architecture-parallel systems-network types-Distributed database- Homogeneous &

Heterogeneous database-Distributed data storage-Case study-Oracle.

Reference

A.Silbersehatz,H.F.Korth and Sudharshan, Database System concepts-IV Edition,McGraw Hill international Edition.

C.J.Date –An Introduction to Database Systems-7th Edition-Addison Wesly-2000.

CORE 7 : Visual Programming in .Net

Subject Code :

Duration : 3 Hours Max Marks : 100

Unit I: Visual Basic .NET Environment
Introduction to .NET framework – CLR - Introduction to VB.NET – Visual studio Environment –Writing first visual basic project – Finding and fixing errors – Project Debugging.

Unit II: Building the User Interface
Introducing More Controls – Working with multiple controls – coding for the controls- Variables – Constants – Calculation – Formatting Data – Handling Exceptions – Display messages in message boxes.

Unit III: Decision and Common Dialog Boxes
If statements – Conditions- Nested IF – Using If statements with radio check boxes – Input Validation – Event Procedure – Menus – Common Dialog boxes – Creating Context Menus and Writing General Procedures.

Unit IV: Object Oriented Programming
Object Oriented Programming – Classes – Creating a new Object using Class – constructors and destructors – Inheritance - List boxes and Combo boxes – Loops – Arrays.

Unit V: Data Base Development
Using ADO.NET and Visual Basic – Creating a Connection – Setting up a Data Adapter – Data Set – Binding data to Controls – Creating Database Application – Using Data bound labels- Populating combo boxes with data.

Text Book:

1. Julia Case Bradley, Anita C. Millspaugh, “Programming in Visual Basic .NET”, Tata McGraw Hill Edition, New Delhi.

Reference Book:

1. Michael Halvorson, “Microsoft Visual Basic .NET Step by Step”, PHI, New Delhi.
2. Tony Gaddis, Kip Irvine, Bruce Denton, ”Visual Basic .NET Programming 2nd Edition.
3. Rebecca M.Riordan, “Microsoft ADO.NET Step by Step”.

CORE 8 : Java Programming

Subject Code :

Duration : 3 Hours Max Marks : 100

Unit I

Evolution of Java Language – Features of Java – Object oriented Concepts – Lexical Issues : Reserved Keywords, identifiers, Literals, operators, Separators- Control Statements.

Unit II

Class – Objects – Methods – Overloading methods- Constructors: Usage of Constructors, 'this ' Keyword, Constructor overloading , Copy Constructors – Static Data members – Static methods – "finalize()' method – Access Control – Inheritance :Inheriting the variables in a class, Inheriting the methods in a class, Overriding methods, 'super' keyword, Inheritance and constructors – Abstract classes – Final Classes

Unit III

Interfaces – Packages : Package Statement , Placing the Class in a package, Package Hierarchy, Import statement, Access protection- Exception Handling : Default Exception handling, User defined Exception Handling, Exception and Error classes , throw and throws, Custom Exceptions.

Unit IV

Threads: Thread, Life cycle of a Thread, Creating and running Threads, Runnable Interface Synchronization, deadlock, Inter thread Communication, Multithreading - I/O stream : File Streams - String : String class, methods in string class, string buffer -Util : working with util package classes.

Unit IV

Applets:Life cycle of an applet, Applet class, methods in the Graphics class – AWT: working with windows using the AWT class,AWT controls, Layout managers, menus and dialogs – JDBC – Introduction to servlets.

Text Books

P. Naughton and H.Schildt – Java 2 (The complete Reference)-Third Edition , TmH 1999

Cay S. Hortsmann Gary cornell – Core Java2 Volume 1 Fundamentals , 5th edition phi 2000

References

K. Arnoll and J.Gosling – The Java Programming Language Second Edition, Addison Wesley 1996.

CORE 9 : Lab 4 – Programming in Java

Subject Code :

Duration : 3 Hours Max Marks : 100

Applications

1. Write a program to find the area and perimeter of a circle using bufferReader class.
2. Write a program to remove a substring from a string
   a) Using String Buffer Class
   b) Write a program to illustrate simple string manipulation using char array.
3. Write a program to determine the order of numbers generated randomly using random class.
4. Write a program to illustrate the use of Calendar class
5. Write a program to illustrate the methods in rectar class.
6. Write a program to illustrate exception handling feature.
7. Write a program to create a custom exception
8. Write a program to illustrate Thread creation and usage
9. Write a program to illustrate synchronization concept in Threads
10. Write a program to create and manipulate email address.

Applets

1. Write a applet program to draw various graphical shapes.
2. Write a program to illustrate incorporation of colours in as applet
3. Write a applet program to draw the familiar traffic signal post with STOP, LISTEN and PROCEED Signals
4. Write a program to illustrate the usage of Font Class.
5. Write a program to a image display using point class and mouse concepts
6. Write a applet program to illustrate the frame window.
7. Write a program to illustrate the Dialog window
8. Write a program to illustrate the menu and submenu controls
9. Write a program to illustrate the borders layout
10. Write a program to illustrate the panel and Grid Layouts.

CORE 10: Lab 5 -VB.Net and RDBMS

Subject Code :

Duration : 3 Hours Max Marks : 100

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1. Form Design – Keyboard & Mouse events, Control arrays, file system controls.
2. Write a program for Keyboard and Mouse events.
3. Write a simple program using standard tool box controls.
4. Write a program using formatting function.
5. Write a program to implement exception handling.
6. Write a simple program using control structures.
7. Write a simple program using input validation function.
8. Adding Menus in form.
9. Write a program using common dialog boxes.
10. Write a program using classes and objects.
11. Write a simple program to implement inheritance.
12. Database application using Data Adapter control for inventory report.
13. Create Database application to display data using Data Grid control for employee database.
14. Create Database application navigate through dataset using Data bound Labels for displaying book details.
15. Create Database application to populate Combo boxes using multiple Data Adapters for Students Mark list.

CORE 11 : Advanced Java

Subject Code :

Duration : 3 Hours Max Marks : 100

Unit I

Servlet overview – the Java web server – your first servlet – servlet chaining – server side includes- Session management – security – HTML forms – using JDBC in servlets – applet to servlet communication.

Unit II

Java Beans: The software component assembly model- The java beans development kit-developing beans – notable beans – using infobus - Glasgow developments - Application Builder tool- JAR files-Introspection-Bound Properties-Persistence-customizers - java beans API.

Unit III

EJB: EJB architecture- EJB requirements – design and implementation – EJB session beans-EJB entity beans-EJB Clients – deployment tips, tricks and traps for building distributed and other systems – implementation and future directions of EJB-Variable in perl- perl control structures and operators – functions and scope.

Unit IV

RMI – Overview – Developing applications with RMI:Declaring & Implementing remote interfaces-stubs & skeletons,Registering remote objects,writing RMI clients –Pushing data from RMI Servlet – RMI over Inter- ORB Protocol.

Unit V

JSP –Introduction JSP-Examining MVC and JSP -JSP scripting elements & directives-Working with variables scopes-Error Pages - using Java Beans in JSP Working with Java Mail-Understanding Protocols in Javamail- Components-Javamail API-Integrating into J2EE-Understanding Java Messaging Services-Transactions.

Text Books:

1. J. McGovern,R. Adatia,Y. Fain, 2003, J2EE 1.4 Bible, Wiley-dreamtech India Pvt. Ltd, NewDelhi.
2. H. Schildt, 2002, Java 2 Complete Reference, 5th Edition, Tata McGraw-Hill, New Delhi.

Reference Books:

1. K. Moss, 1999, Java Servlets, Second edition, Tata McGraw Hill, New Delhi.
2. D.R.Callaway, 1999, Inside Servlets, Addison Wesley, Boston
3. Joseph O'Neil, 1998, Java Beans from the Ground Up, Tata McGraw Hill, New Delhi.
4. TomValesky, Enterprise JavaBeans, Addison Wesley.

5. Cay S Horstmann & Gary Cornell, Core Java Vol II Advanced Features, Addison Wesley.

CORE 12 : Web Technology

Subject Code :

Duration : 3 Hours Max Marks : 100

Unit I

Internet Basics : Basic Concepts – Communication on the internet – Internet Domains – Internet Server Identities – Internet Connectivity – The Structure of an Internet Address – Overview of TCP/IP – Internet Protocol – IP Structure – TCP – FTP – Telnet.

Unit II

Introduction to HTML : Web Server – Web Client/Browser – The structure of an HTML program – Text Formatting – Text Styles – Text Effects. Lists : Ordered List – Unordered List – Definition List. Adding graphics to HTML documents : Image, Tables, Colors. Links : Link – Alink – Vlink – Internal document reference – External document reference – Image as Hyper link. Frames : Frameset – Noresize – Scrolling.

Unit III

DHTML : CSS – Font attributes – Color and Background attributes – Text attributes – Border attributes – Margin related attributes – List attributes- class – SPAN tag – External style sheet.

Unit IV

Introduction to Javascript : The advantages of javascript – Javascript into HTML – Javascript syntax – variables. Operators : Arithmetic – Logical – Comparison – Assignment – Conditional. Javascript programming constructs : If – Switch – While – For – Do While – Label – Break – Continue. Array – Dense Array .

Unit V

Functions in javascript : Built-in – functions – User defined functions – Declaring functions – Function with parameters and return value – Recursive function – Placing text in a browser. Dialog Boxes : Prompt – Confirm – Alert. Javascript DOM – Browser object – Document object - Form object and Form elements. Built – in objects: String object – Math object – Date object – User defined object – Cookies.

Text Book

Web Enabled Commercial Application Development using HTML, DHTML,

Javascript, Perl , CGI – Ivan Bayross – BPb Publications (Revised Edition).

Reference

Mastering javascript – J.Jaworkshi – Bpb Publications 1999.

The Complete Reference HTML (third edition)- T. A. Powell – TMH –2002.

CORE 13 : Data Communication Network

Subject Code :

Duration : 3 Hours Max Marks : 100

Unit I

Introduction- Network Models- Data and Signals-Digital Transmission-Analog Transmission.

Unit II

Bandwidth Utilization: Multiplexing and Spreading-Transmission Media- Switching-Error Detection and Correction-Data Link Control-Multiple Access.

Unit III

Wired LANs: Ethernet-Wireless LANs-Connecting LANs, Backbone Networks, and Virtual LANs

Unit IV

Network Layer: Logical Addressing-Internet Protocol- Address Mapping, Error Reporting, and Multicasting- Delivery, Forwarding, and Routing

Unit V

Process-to-Process Delivery: UDP, TCP, and SCTP-Congestion Control and Quality of Service-Domain Name System--Remote Logging, Electronic Mail, and File Transfer-WWW and HTTP-Network Management: SNMP

Text Book

Behrouz A Forouzan “Data Communications and Networking” Fourth edition

Reference

Tanenbaum “Computer Networks” fourth Edition

CORE 14 : Lab 6 – Java and Web Application

Subject Code :

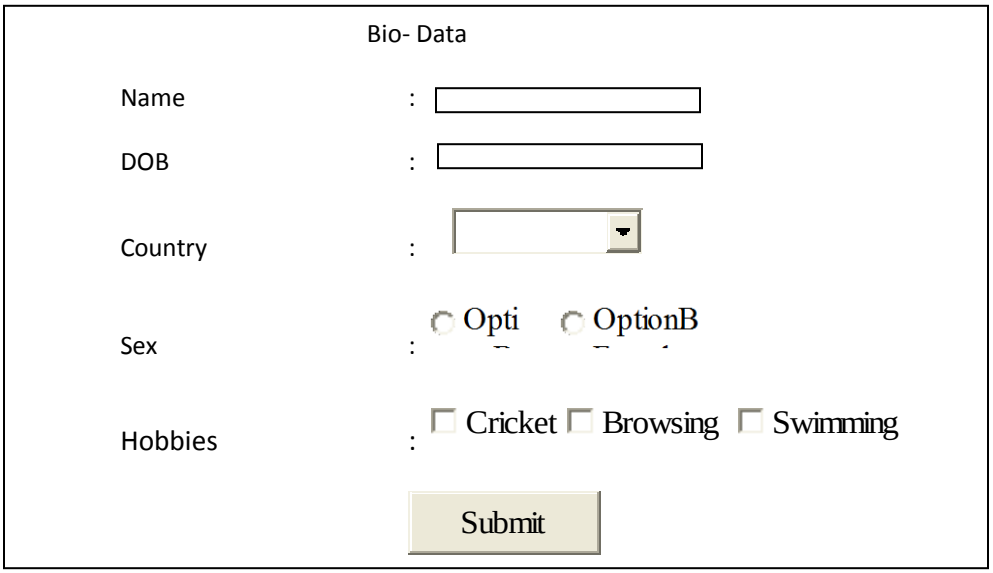
Duration : 3 Hours Max Marks : 100

WEB DESIGN

1) Design a web page in html for your college. Use links for day college and evening college.The day college courses are viewed in bullet list and evening college courses are viewed in ordered list. College logo is viewed in left top corner of home page. Headers are aligned center. Type 2 paragraphs about college. Give different background color and fore color for the document. Display the course fee details in a table. Draw a rule between heading and paragraphs. Display contact details in footer of web page.

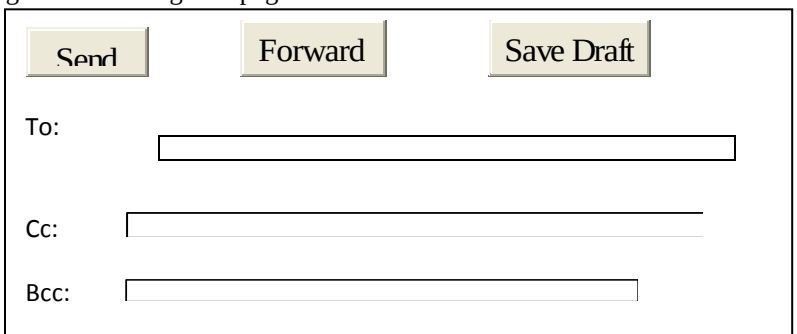
2) Design a web page in html for your course. The subjects are listed in the left frame of a frameset. If the user clicks on the subjects, the particular details of the subject are listed in the right frame of a frameset.

3) Design a web page for your bio data in the following format.



4) Design a web page for your class time table. Use colspan property or rowspan property. Set different background image for the table and document.

5) Design the following web page.



6) Write a javascript program to create a simple calculator.

7) Create a javascript program to find the sum of N numbers using array.
(Use prompt,alert,writeln methods).

8) Create a javascript program that permits a user to move previous and next web pages from the current page on button click event.(use history object)

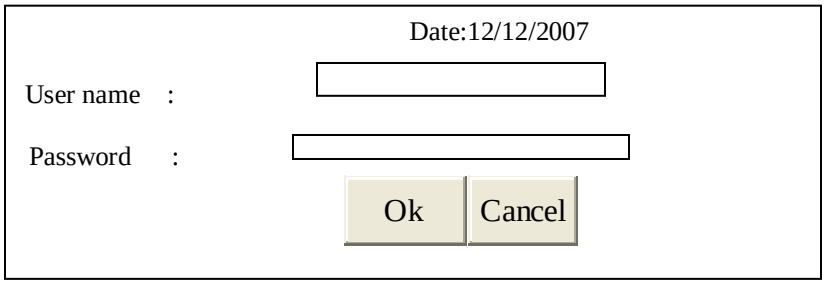
9) Open a new window in a mouse over event. Close the current window in a button click event. Close a new window after 5 seconds automatically. Use window object.

10) Create a javascript program which displays the browser information(browser,version….etc) after getting confirmation from the user.(use confirm method).

11) Create a javascript program to display “good morning” or “good afternoon” or “good night” message by checking the current time. Use if statement.

12) Create a script program which gets the visitor name and returns his name character by character. In the next line, it displays whether the visitor is visiting this web site first time or more. If it is first time , welcome message is displayed before his name.(use cookie).

13) Design the login web page and check the username, password by using script program. Display only the current date in a web page. Display the errors.



ELECTIVE-1 : Digital Fundamentals and Computer Architecture

Subject Code :

Duration : 3 Hours Max Marks : 100

Unit – I

Digital Logic Circuits: Logic gates – Boolean Algebra – Map simplication – Combination cirucits – Flip-flops. Data Representaion: Data types – Fixed point representaion – Floating point representaion.

Unit – II

Central Processing Unit: General Register Organization – Stack organization – Instruction formats – Addressing modes – Data transfer and manipulation – Program control – CISC and ISC characteristics.

Unit – III

Pipeline and Vector processing: Parallele Processing – Pipelining – Arithmetic Pipline – Instruction Pipeline – Vector processing – Array Processors.

Unit – IV

Computer Arithmetic: Addition and Subtraction – Multiplication algorithms – Division algorithms – Floating point arithmetic operations.

Unit – V:

Input – Output organization: Input – Output interface – Asynchronous data transfer – Modes of transfer – Direct Memeory Access – Serial communication. Memory organization: Associative memory – Cache memory – Virtual memory – Multprocessors: Characteristics – Interconnection structures – Interprocessor communication and synchornization.

Text Book:

1. Computer System Architecture by M. Morris Mano, Third edition, Perason education.

Reference Book:

1. Digital logic and computer design by Charles H.Roth.
2. Computer Architecture and Organization by John P. Hayes, McGraw Hill.

ELECTIVE-2 : Operation Research

Subject Code :

Duration : 3 Hours Max Marks : 100

Unit-I

Linear programming – Formulation – Graphical solution (2 variables only) of LPP – Development of simplex method –Artificial variable techniques – Big-M method – Revised simplex method.

Unit –II

Duality in linear programming and its formulation -Dual simplex method –Bounded variables method –Applications of LPP –Transportation problem –Assignment problem –Traveling salesman problem.

Unit-III

Integer programming problem (IPP) –cutting plane algorithm – Branch and method of solving IPP –Dynamic programming problem and its characteristics –Deterministic dynamic programming problem.

Unit-IV

Sequencing problem –Processing n jobs through two machines and three machines –Processing 2 jobs through m machines –Project scheduling by PERT/CPM – difference between PERT and CPM –Constructing the network –critical path analysis –Float of an activity-three time estimated for PERT –project cost by CPM.

Unit-V

Stochastic process –Classification of stochastic processes – Discrete parameter Marko chains – continuous –queuing models and its characteristics –Classification of Queuing models – (M/M/1):(/ FCFS) (birth and death model).

BOOKS FOR STUDY:

1. H.A. TAHA Operations Research, 3rd edition, PHI-1995.
2. Sharma J.K. Mathematical models in operations research, tata McGraw hill pub company ltd., new Delhi (1989).
3. Trivedi K.S: Probability science applications, prentice hall of India- private limited, new Delhi (1994).

ELECTIVE-3: Neural Networks

Subject Code :

Duration : 3 Hours Max Marks : 100

Unit 1

Introduction to Neural Networks – Basic Concepts of Neural Networks – Inference and Learning– Classification Models – Association Models – Optimization Models – Self Organization Models

Unit 2

Supervised and Unsupervised Learnings – Statistical Learnibg – Al Learning – Neural Networks Learning – Rule Based Neural Networks – Networks Training – Networks Revision – Issues – Theory of Revision – Decision Tree Based NN – Constraint based NN.

Unit 3

Incremental Learning – Mathematical and Modelling – Application of NN – Knowledge based Approaches

Unit 4

Heuristics – Hierarchical Models – Hybrid Models – Parallel Models – Different Models – Control Networks – Symbolic Methods – NN Methods.

Unit 5

Structure and Sequence – Spatio temporal NN – Learning Procedures – Knowledge based Approaches

Text Books

Limin Fu - Neural Networks in Computer Intelligence – McGraw Hill International Edition - 1994

Robert J Schalkoff – Artificial Neural Networks – McGraw Hill – 1997.

ELECTIVE-4: Artificial Intelligence and Expert Systems

Subject Code :

Duration : 3 Hours Max Marks : 100

Unit – I : Problems and Search

AI Problems – AI Techniques – Level of the Model – criteria for success - Defining problem as a state space search – Production systems – Problem characteristics – production system characteristics – Heuristic search techniques : Simple hill climbing – best-first search – Problem reduction – constraint satisfaction – Means-end analysis.

Unit – II : Knowledge Representation

Representations and Mappings – Approaches to knowledge representation – issues in knowledge representation – Representing simple facts in logic – Resolution – Procedural versus declarative knowledge – forward and backward reasoning – conceptual dependency.

Unit – III : Game Playing

Minimax search procedure – alpha-beta cut-offs – additional refinements – iterative deepening – components of a planning system.

Unit – IV : Learning

Rote learning – learning by taking advice – learning in problem solving – induction – explanation based learning – Formal learning theory.

Unit -V: Expert systems

Representing and using domain knowledge – expert system shells – knowledge acquisition – real time search – perception – action -robot architectures.

Reference :

1. "Artificial Intelligence" by Elaine Rich, Kevin Knight, Shivashankar B Nair, McGraw Hill Publications, Third Edition.

ELECTIVE-5: Object Oriented Analysis and Design

Subject Code :

Duration : 3 Hours Max Marks : 100

Unit I

Object oriented system development, objects, classes, object behaviours and methods,Encapsulation and Information hiding, polymorphism, object oriented development life cycle

Unit II

Object oriented methodologies, Rambaugh methodology, Booch methodology, Jacobson methodology, patterns, frameworks, The unified Approach, UML class diagrams, Use case diagrams

Unit III

Object Oriented Analysis, Use case models, Object Analysis, Object relationships, attribures, methods, class and object responsibilities, case studies

Unit IV

Object Oriented design process, Design Axioms, Corallaries, design patterns, designing classes, UML object constraint language, class visibility, designing methods and protocols

Unit V

Quality Assurance test, testing strategies, Object orientation on testing, Test cases, test plans, continuous testing, debugging, principles, system usability,measuring user satisfaction, case studies

Main Reading

1. Ali Bahrami Object Oriented system development Mc Rawhill International edition 99

Supplementary Reading

1. R S Pressman Software Engineering McRawhill International edition 99
2. Grady Booch Object oriented Analysis Design – Addison Wesley

ELECTIVE-6: Software Testing

Subject Code :

Duration : 3 Hours Max Marks : 100

Unit – I

Introduction to testing - Role of Process in Software Quality, Testing as a Process, Basic Definitions, Software Testing Principles, The Tester's Role in a Software Development Organization, Origins of Defects, Defect Classes, The Defect Repository and Test Design, Defect Examples

Unit – II

Introduction to Testing Design Strategies, The Smarter Tester, Test Case Design Strategies, Using Black Box Approach to Test Case Design, Random Testing, Equivalence Class Partitioning, Boundary Value Analysis, Other Black-box Test Design Approaches, Black-box testing and COTS.

Unit – III

Using White-Box Approach to Test design, Test Adequacy Criteria, Coverage and Control Flow Graphs, Covering Code Logic, Paths: Their Role in White-box Based Test Design, Additional White Box Test Design Approaches, Evaluating Test Adequacy Criteria

Unit – IV

The Need for Levels of Testing, Unit Test, Unit Test Planning, Designing the Unit Tests. The Class as a Testable Unit, The Test Harness, Running the Unit tests and Recording results, Integration tests, Designing Integration Tests, Integration Test Planning, System Test – The Different Types, Regression Testing, Alpha, Beta and Acceptance Tests

Unit -V

Introductory Concepts, Testing and Debugging Goals and Policies, Test Planning, Test Plan Components, Test Plan Attachments, Locating Test Items, Reporting Test Results.
Defining Terms, Measurements and Milestones for Controlling and Monitoring, Status Meetings, Reports and Control Issues, Criteria for Test Completion, SCM, Types of reviews, Components of Review Plans, Reporting review results

Text Book

1. "Practical Software Testing" by Ilene Burnstein, Springer International Edition, 2003

References

1. Elfriede Dustin, "Effective Software Testing", Pearson Education, New Delhi, 2003
2. Renu Rajani and Pradeep Oak, "Software Testing – Effective Methods, Tools and Techniques", Tata McGraw-Hill, New Delhi, 2003

ELECTIVE-7: Data Warehousing and Data Mining

Subject Code :

Duration : 3 Hours Max Marks : 100

Unit I

Data Warehouse Architecture: Data Warehousing architecture – System process – Architecture design – Database schema – Partitioning strategy – Aggregations – Data Marting – Metadata – Data warehouse process managers.

Unit II

Hardware & Operational Design: Hardware and Operational design of warehouses – Hardware architecture – Physical layout – Security – Backup and Recovery – Service level agreement – Operating the Data warehouse.

Unit III

Planning, Tuning & Testing: Capacity planning – Tuning the Data warehouse - Testing the Data warehouse.

Unit IV

Data Mining Introduction: Data Mining introduction – Data mining Vs Query pools – Data mining in marketing and Self-learning computing system – Concept learning – Data Mining and Data Warehousing.

Unit V

Knowledge Discovery Process: Data searching – Cleaning – Enrichment – Coding – Preliminary Analysis of Data Set using traditional Query pools – Visualization techniques – OLAB tools – Neural Networks – Genetic Algorithms – Knowledge Discovery Algorithm (KDA).

Main Reading

1. "Data Warehousing in the Real World" – Sam Anahory & Dennis Murray - Pearsoned Education
2. "Data Mining" – Dolf Zanting - Pearsoned Education

Supplementary Reading

1. "Data Mining Concepts and Techniques" – Jiawei Han and Micheline Kamber.
2. "Data Mining Techniques" – Arun K. Pujari, University Press.

ELECTIVE-8: Distributed Operating System

Subject Code :

Duration : 3 Hours Max Marks : 100

Unit 1

Introduction – Client –Server Paradigm- mThreads in Distributed Systems – Remote Procedure call- Remote Object Invocation- Message Oriented Communication- Unicasting- Group Communication – Reliable and Unreliable Multicating.

Unit 2

Issued in Distributed Operting System- Lamports Logical Clock- Vector Clock –Causal Ordering _ Global States-Election Algorithms- Distributed Mutual Exclusion _ Distribvuted Transactions – Distribuited Deadlock – Agreeement Protocal.

Unit 3

Introduction –Date –Centric Consistency Models- Cllient-Centric Consistency Models- Distribution Protocals = mConsistency Protocols –Ivy-Munin-Automic Transaction.

Unit 4

Introductin to Fault tolerance –Distribvuted Commit Protocol-Distributed File System Architecture – Issued in Distributed Fils Systems-sun NFS.

Unit 5

Distributed Object Based Systems- CORBA-COM-Distributed coordination Based System-JINI.

Text Books

1 .Geortge Couloruis , Jean Dollimore, Tim Kindberg, “Distributed Systems Concepts and Deisign” Thid edition perason education Asia 2002.

2. mukesh singhal, Advanced Concepts in Operaging System” Mc Graw Hill Series in Computer Science, 1994.

Reference:

1.A.S. Tanenbaum, M.Van Steen, “ Distributed Systems” OPderarson Education , 2004.

2.M.L. Liu, “Distributed Computing Principles and Applications “ Person Addision Wsley, 2004.

ELECTIVE-9: Mobile Computing

Subject Code :

Duration : 3 Hours Max Marks : 100

Unit I : Introduction

Wireless Transmission – Signal Propagation - Spread Spectrum – Satellite Networks-Capacity Allocation – FAMA – DAMA –MAC.

Unit II : Mobile Networks

Cellular Wireless Networks – GSM – Architecture – Protocol – Connection Establishment – Frequency Allocation – Routing – Handover-Security – GPRS.

Unit III : Wireless Networks

WirelessLAN – IEEE 802.11 Standrd – Architecture – Services – AdHoc Networks – HiperLan – Blue Tooth.

Unit IV: Routing

Mobile IP – DHCP – AdHoc Networks- Proactive and Reactive Routing Protocols- Multicast Routing.

Unit V : Transport And Application Layers

TCP over Adhoc Networks – WAP – Architecture – WWW Programming model- WDP – WTLS – WTP – WSP – WAE – WTA Architecture – WML.

Text Books:

1. Jochen Schiller " Mobile Communications" PHI/ Pearson, Second Edition,2003.
2. William Stalling " Wireless Communication and Networks " ,PHI/Pearson 2002.

References:

1. Kaveh Pahlavan, Prasanth Krishnamoorthy ,"Principals of Wireless Networks ",PHI/Pearson ,2003.
2. Uwe Hansmann, Lothar Merk,Martin S.Nicklons and Thomas Stober,"Principles of Mobile Computing ", New York ,2003.
3. Charles E.Perkins,"AdHoc Networking ",Addison Wesley ,2001.

ELECTIVE-10: Distributed Database

Subject Code :

Duration : 3 Hours Max Marks : 100

Unit I

Features of Distributed Versus Centralized Database – Why Distributed Databases – Distributed Database Management Systems (DDBMSs) – Review of Computer Networks – Levels of Distribution Transparency – Reference Architecture for Distributed Database – Types of Data Fragmentation – Distributed Transparency for read – only Applications – Distribution transparency for Update Applications – Distributed Database Access Primitives – Integrity Constraints in Distributed Databases – A Framework for Distributed Database Design – The Design of Database Fragmentation – The Allocation of Fragments.

Unit II

Equivalence Transformations of Queries – Transforming Global queries into Fragment Queries – Distributed Grouping and Aggregate Function Evaluation – Parametric Queries – Optimization of Access Strategies – A Framework for Query optimization – join Queries – General Queries. A Framework for Transaction Management – Supporting Atomicity of Distributed Transactions – Architectural Aspects of Distributed Transactions

Unit III

Foundations of Distributed concurrency control – Distributed Deadlocks – Concurrency Control Based on Timestamps – Optimistic Methods for Distributed Concurrency Control – Reliability – Basic Concepts Nonblocking Commitment Protocols – Reliability and Concurrency Control – Determining a Consistent View of the Network – Detection and Resolution of Inconsistency – Checkpoints and cold Restart – Distributed Database Administrations – Catalog Management in Distributed Databases – Authorization and Protection.

Unit IV

Distributed object database management systems – Fundamental object concepts and Models – object – Abstract Data Types – Composition (Aggregation) – Class – Collection – Subtyping and Inheritance – Object Distribution Design – Horizontal Class Partitioning – Vertical Class Partitioning – Vertical Class Partitioning – Path Partitioning – Class Partitioning Algorithms – Allocation – Replication – Alternative Client / Server Architectures – Cache Consistency – Object Identifier Management – Pointer Swizzling object Migration – Distributed Object Storage – Object Query Processor Architectures – Query Processing Issues – Query Execution – Correctness Criteria – Transaction Models and object Structures – Transactions Management in Object DBMSs – Transactions as Objects – Conclusion – Bibliographic Notes – Exercises.

Unit V

Parallel Database Systems – Database Server Approach – Database Servers and Distributed Databases – Parallel System Architectures – Objectives – Functional Aspects – Parallel Data Processing – Parallel Query Optimization – Data Placement – Query Parallelism – Parallel Execution Problems – Initialization – Interferences and Convoy Effect – Load Balancing – Parallel Execution for Hierarchical Architecture – Problem Formulation – Basic Concepts – Load Balancing Strategy – Performance Evaluation – Conclusion – Bibliographic Notes – Exercises.

Reference

Stefano Ceri, Giuseppe Pelagatti – Distributed Databases Principles &Systems – McGraw – Hill.

M.Tamer Ozsu, Partrcick Valduriez – Distributed database systems – Prentice Hall – Second Edition.

ELECTIVE-11: Multimedia

Subject Code :

Duration : 3 Hours Max Marks : 100

Unit – I :

Definition – Multimedia highway – Multimedia applications – Need for multimedia project – Macintosh versus windows – Networking Macintosh and windows – connections – Memory and storage devices - Input devices – output hardware - communication devices.

Unit – II :

Text in multimedia – Font editing and design tools - Hyper media and hyper text – Multimedia sounds – digital audio – making MIDI audio – MIDI versus digital audio – adding sound to multimedia project. Images: bitmaps, vector drawings, 3D drawing and rendering – colours- principle of animation – animation by computer. Video: How video works – analog display standards – digital display standards – digital video – optimizing video files for CD ROM.

Unit – III :

Multimedia skills: Project manager, Multimedia designer, interface designer, writer, video specialist, audio specialist, multimedia programmer. Web server – web browsers – search engines – web page makers and site builders – plug-ins and delivery vehicles.

Unit – IV:

Working on the web – text, Images, sounds, animations for the web – making instant multimedia – types of authoring tools – card and page based authoring tools - icon and object based authoring tools - time based authoring tools – cross platform authoring tools.

Unit – V :

Planning and costing: Process of making multimedia – scheduling – Estimating – Designing – producing- testing – preparing for delivery – delivery on CD ROM – compact disc technology – delivery on world wide web.

Text book :

1. "Multimedia Making it works" by Tay Vaughan, Seventh edition, McGraw Hill Publications

References :

1. Creating Instructional Multimedia Solutions: Practical Guidelines for the Real World, Peter Fenrich, Informing Science Publication, 2005
2. Multimedia in Action, James E. Shuman, Course Technology Publication, 1997

ELECTIVE-12: Digital Image Processing

Subject Code :

Duration : 3 Hours Max Marks : 100

Unit 1

Elements of Visual Perception – Image sampling and quantization Basic relationship between pixels- Basic geometric transformations-Introduction to Fourier Transform and DFT – Properties of 2D Fourier Transform –FFT- Separable Image Transform – Walsh Hadamard – Discrete Cosine Transform, Haar, Slant – Karhunen Loeve Transforms.

Unit 2

Spatial Domain methods: Basic grey level averaging – Spatial filtering: Smoothing, Sharpening filters – Laplacian filters – Frequency domain filters: Smoothing, Sharpening filters- Homomorphic filtering.

Unit 3

Model of Image Degradation/ restoration process – Noise models- Inverse Filtering- Least mean square filtering- Constrained least mean square filtering – Blind Image restoration – Pseudo inverse – Singular value decomposition.

Unit 4

Lossless compression: Variable length coding – LZW coding – Bit plane coding –predictive coding – DPCM. Lossy Compression: Transform coding – Wavelet coding – Basics of Image Compression standards: JPEG, MEG, Basics of Vector Quantization.

Unit 5

Edge detection – Thresholding – Region based segmentation- Boundary representation: chair codes – Polygonal approximation- Boundary segments – Boundary Descriptors: Simple Descriptors- Fourier Descriptors- Regional Descriptors- Simple Descriptors- Texture

Text Books

Rafael C Gonazalez, Richard E Woods 2nd Edition, Digital Image Processing – Pearson Education 2003

Reference

Willam K Pratt, Digital Image Processing John Willey (2001)
Image Processing Analysis and Machine Vision – Millman Sonka

ELECTIVE-13: Advanced Computer Architecture

Subject Code :

Duration : 3 Hours Max Marks : 100

Unit 1

Overview of Von Neumann Architecture: Instruction set Architecture; The Arithmetic and Logic Unit, The Control Unit, Memory and I/O devices and their interfacing to the CPU; Measuring and reporting performance; CISC and /RISC processors

Unit 2

Pipelining : Basic Concepts of Pipelining, Data hazards, Control hazards and Structural hazards; Techniques for overcoming or reducing the effects of various hazards.

Unit 3

Instruction-level parallelism: Concepts of Instruction-level parallelism (ILP), Techniques for increasing ILP; Superscalar, Super pipelined and VLIW processor Architecture; Vector and Symbolic Processors; case studies of Contemporary Microprocessors

Unit 4

Multiprocessor Architecture: Taxonomy of parallel Architectures; Centralized Shared-Memory Architecture, Synchronization, Memory Consistency, Interconnection Networks; Distributed Shared-Memory Architecture, Cluster Computers.

Unit 5

Non Von Neumann Architecture: Data flow Computers, Reduction Computer Architectures, Systolic Architectures.

References

1. Computer Organization and Architecture: Designing for performance, W.Stallings, 4th Ed. PHI, 1996.
2. Computer Architecture: A Quantitative Approach, J.H.Hemmessy and D.A.Patterson, 2nd Ed., Morgan Kaufmann, 1996
3. Advanced Computer Architecture: Parallelism, Scalability and Programmability, Kai Hwang, McGraw-Hill Inc 1993.
4. Parallel Computer Architecture: A Hardware / Software Approach, D.E.Culler, J.Pal Singh, and A.Gupta, HarcourtAsia Pvt Ltd., 1999.

ELECTIVE-14: Parallel Computing

Subject Code :

Duration : 3 Hours Max Marks : 100

Unit 1

Introduction to Parallell Processing- Evolution off Computer Systems- Parallelism in Uniprocessor Systems- Parallel Computer Structures – Archietectural Classification Schemes- Parallel Processing Applications.

Unit 2

Memoru and Input-Out Put Substems- Hierarchical Memory Structure- Virtual Memory Sytstem- Memoryu Allocation and Management – mCache Memories and Management0 Input – Output Sbstem

Unit 3

Principles of Pipellining and Vector Processing- Pipelining : An Overlapped Parallellism- Instruction and Arithmetic Pipelines – Principles of Designing Pipelined Pricessors _ Vector Processing Requirements.

Unit 4

Vecturozation and Optimization methods 0- Parallel Languages for Vector Processing- Design of Vectorising Compiler _ Optimiozation of Vector Functions- S IMD Arry Processor-SIMD interconnection Networks- Associative Array Processing.

Unit 5

Multiprocessor Architecture and Programming –functional Structures – Interconnection Networks – Parallel Memory Organizations _ multiprocessor Operating Systems- Language Features to Exploit Parallelism- Multiprocessor Scheduling Strategies. ‘

Text Books.:

Kai Hwang and Faye A. Briggs- Computer Architecture and Parallel Processing- McGraw Hill Internation Edition- 1985.

Reference:

1.Richard Kain _ Adavanced Computer Architecture – PHI -1999

2. V. Rajaraman and C. Silva Ram Murchy _ Parallel Computers, Architecture and Programming –PHI -2000

ELECTIVE-15: Network Security and Cryptography

Subject Code :

Duration : 3 Hours Max Marks : 100

Unit I

Introduction -OSI Security Architecture, Security Attacks, Security Services, Security Mechanism, A model for Network Security; Classical Encryption techniques-Block Ciphers and data Encryption Standards-Advanced Encryption standard-Multiple Encryption and Triple DES-Block Cipher Modes of Operation-Stream Cipher and RC4-Confidentiality Using Symmetric Encryption.

Unit II

Introduction to Number Theory- Public-Key Cryptography and RSA-Key Management; Other Public- Key Cryptosystems.

Unit III

Message Authentication and Hash Functions –Hash Functions and MAC Algorithms – Digital Signatures and Authentication Protocols.

Unit IV

Authentication Applications – Electronic Mail Security - IP Security – Web Security.

Unit V

Intruders-Malicious Software – Firewalls

Text Book

William Stallings, “Cryptography And Network Security – Principles and Practices”, Prentice Hall of India, Fourth Edition, 2006.

References

Atul Kahate, “Cryptography and Network Security”, Tata McGraw-Hill, 2003.

ELECTIVE-16: E-Commerce

Subject Code :

Duration : 3 Hours Max Marks : 100

Unit – I

Overview of e- commerce: Introduction – Definition of e-commerce – Potential benefits of e- commerce – Internet and www as enablers of e- commerce – Impact of e- commerce on business models – E- commerce security – Organization of topics – Implication for the accounting. E- commerce and the role of independent third parties: Introduction – Consulting practices and accountants – Impact of Electronic commerce on the traditional assurance function – third party Assurance of web based electronic commerce – Implications for the accounting.

Unit– II

Edi electronic commerce and Internet: Introduction – Traditional Edi system – Data transfer and standards – financial Edi – Edi system and the internet – Impact of Edi Internet applications on the accounting profession. Risks of insecure system : Introduction – Overview of risks associated with internet transactions – Internet associated risk – Internet associated risk – risks associated with business transactions – Risks associated with confidentially maintained archival – master file and reference data – risks associated with virus and malicious – Implication of the accounting.

Unit – III

Internet security standards: Introductions – Standard setting issues and Committees – Security committees and organization- Security protocols and languages – Messaging protocols – Secure electronic payments and protocols – the role of accountants in internet related standard setting process. Cryptography and authentication: Introduction – Message security issues Encryption techniques – key management- Additional authentication methods – Additional non – repudiation techniques – implications of the accounting.

Unit – IV

Firewalls: Introduction – firewall defined – TCP/IP- Open system interconnect (OSI)- Components of firewall – typical functionality of firewalls 0 network topology – Commercial firewall software – Limitations of security prevention provided by firewall Implications of the accounting – Introduction – the set protocol – Magnetic strip cards – smart cards – Electronic check – Electronic cash – Implication of the accounting.

Unit – V

Intelligent Agent: Introduction – Definition of intelligent agent – Capabilities Of intelligent agent – intelligent agents and e-commerce – Online information Chain – limitations agents – implication of the accounting. Web based marketing: Introduction – the scope of marketing – business marketing and information technology – internet marketing techniques – Online adv Mechanisms – Web site design issues – intelligent agent and their impacts on marketing techniques – Implications of the accounting.

Books for Study :

1. MARILYN GREENSTEIN, TOOD.M.FEINMAN, “electronic Commerce”-TMH.
2. KALAKOTA & WINSTON, Frontiers of Electronic Commerce – Addison Wasley, fifth

3. BAJAJ & NAG , E-Commerce, The cutting Edge of Business – Tata McGraw HIll