

**CENTURION UNIVERSITY OF TECHNOLOGY
AND MANAGEMENT, ODISHA**

SCHOOL OF APPLIED SCIENCES



Centurion
UNIVERSITY

*Shaping Lives...
Empowering Communities...*

COURSE STRUCTURE AND SYLLABUS

FOR

BCA 2ND Year

CENTURION UNIVERSITY OF TECHNOLOGY AND MANAGEMENT, ODISHA

BACHELOR IN COMPUTER APPLICATIONS

Course Structure under CBCS – II Year

<i>II Year Semester 3</i>				<i>II Year Semester 4</i>			
<i>Subject Code</i>	<i>Subject Name</i>	<i>L+T+P</i>	<i>Credits</i>	<i>Subject Code</i>	<i>Subject Name</i>	<i>L+T+P</i>	<i>Credits</i>
	SEC - 1	0+0+3	2		SEC - 2	0+0+3	2
BCAC2301	Introduction to Data Structure	4+0+3	6	BCAC2401	Programming in C++	4+0+3	6
BCAC2302	RDBMS	4+0+3	6	BCAC2402	Operating System Concepts	4+0+3	6
BCAC2303	Fundamentals of Algorithm Design and Analysis	5+1+0	6	BCAC2403	Computer Communication and Networking	4+0+3	6
GE - 3	Subject Specific		6	GE - 4	Subject Specific		6
<i>Total Semester Credits</i>			26	<i>Total Semester Credits</i>			26
<i>Total Cumulative Credits</i>			66	<i>Total Cumulative Credits</i>			92

Skill Enhancement Courses (02 papers) (Credit: 02 each)- SEC1 to SEC2

<i>Sl. No.</i>	<i>Subject Code</i>	<i>Subject Name</i>	<i>L+T+P</i>	<i>Credits</i>
1	BCAS2001	Computer Hardware and Maintenance	2+0+3	4
2	BCAS2002	Advance Linux Administration	0+0+3	2
3	BCAS2003	PHP Programming	0+0+3	2
4	BCAS2004	Programming with Visual Basics in Visual Studio .NET	0+0+3	2

BACHELOR IN COMPUTER APPLICATIONS

Course Structure under CBCS – III Year

<i>III Year Semester 5</i>				<i>III Year Semester 6</i>			
<i>Subject Code</i>	<i>Subject Name</i>	<i>L+T+P</i>	<i>Credits</i>	<i>Subject Code</i>	<i>Subject Name</i>	<i>L+T+P</i>	<i>Credits</i>
	SEC - 1	0+0+3	2		SEC - 2	0+0+3	2
BCAC3501	Introduction to Data Structure	4+0+3	6	BCAC3601	Programming in C++	4+0+3	6
BCAC3502	RDBMS	4+0+3	6	BCAC3602	Operating System Concepts	4+0+3	6
DSE - 1	Subject Specific		6	DSE – 3	Subject Specific		6
DSE - 2	Subject Specific		6	DSE - 4	Subject Specific		6
<i>Total Semester Credits</i>			<i>26</i>	<i>Total Semester Credits</i>			<i>26</i>
<i>Total Cumulative Credits</i>			<i>66</i>	<i>Total Cumulative Credits</i>			<i>92</i>

Discipline Specific Elective Courses (04 papers) (Credit: 06 each)- DSE 1 to DSE 4

Sl No	Subject Code	Subject Name	Subject Type (L+T+P)	Credits
1	BCAD3001	Programming using python	4+0+3	6
2	BCAD3002	Cryptography and Network Security	5+1+0	6
3	BCAD3003	Cyber Crime and Law	5+1+0	6
4	BCAD3004	Principles of MIS	5+1+0	6
5	BCAD3005	Data Mining and Ware Housing	5+1+0	6
6	BCAD3006	Enterprise Resource Planning	5+1+0	6
7	BCAD3007	Dissertation/ Project	5+1+0	6

SYLLABUS

Semester: III

BCA2301 Introduction To Data Structure

CODE	SUBJECT NAME	PREREQUISITE	COURSE TYPE	CREDIT	L-T-P
BCAC2301	Introduction To Data Structure	Programming In C	THEORY+ PRACTICE	6	4-0-3

MODULE-I (25 HRS)

Introduction to Data Structures: Data Structures, Need of data structure, Computer Memory, Algorithm, Pseudo code for expressing algorithms, time complexity and space complexity.

Linear Structures of Array: Memory representation, Implementation and application, sparse matrix, Advantages and Disadvantages of array

Sorting and searching: Bubble, Selection, Insertion, linear search, binary search

Stack: Memory representation, implementation and application of stack (Conversion from Infix to Postfix, Evaluation of postfix expressions), Disadvantages of stack

Queue: Queues: Memory representation, implementation and application of a queue, Priority Queues, Circular Queues. Advantages and Disadvantages of queues

Link list: Memory representation, implementation and application, Linked stacks and queues, operations on Polynomials, Doubly Linked Lists, Circularly Linked Lists. Advantages and Disadvantages of linked list.

MODULE-II (20 HRS)

Tree: Concept of tree: Definition : Tree, Binary tree, Complete binary tree, Binary search tree, : Root, Node, Degree of a node and tree, Terminal nodes, Non terminal nodes, Siblings, Level, Edge, Path, depth, Parent node, ancestors of a node. Binary tree: Array representation of tree, Creation of binary tree. Traversal of Binary Tree: Preorder, Inorder and postorder.

MODULE-III (5 HRS)

Graphs: Terminology & Representations, Graphs & Multi-graphs, Directed Graphs, Sequential Representations of Graphs, Adjacency Matrices, Traversal.

Text Books:

1. Data Structures: Seymour Lipschutz

Reference Books:

1. Data Structures in C by Tanenbaum.

2. Fundamentals of Data Structure by Sahany

3. Data Structures, by Tremblay and Sorenson.

4. Data Structure & Algorithms using C ,Amitav Nag and J P Singh, 2nd Edition, Vikas Publishing House Pvt Ltd.

PRACTICAL

1. Write a Program to Traverse an Array.
2. Write a Program to Insert and delete an Item into an Array.
3. Write a program to search an element using sequential search.
4. Write a program to search an element using binary search.
5. Write a program to implement stack operation using array.
6. Write a program to convert an infix to postfix notation using stack.
7. Write a program for stack implementation using linked list.

8. Write a program to implement queue operation using array.
9. Write a program to implement circular queue operation using array.
10. Write a program for queue implementation using linked list.
11. Write a program to implement link list (creation, insertion, deletion).
12. Write a program to implement circular link list (creation, insertion).
13. Write a program to implement double link list (creation, insertion).
14. Write a program to construct binary tree.
15. Write a program to traverse (in order, preorder, post order any one).
16. Write a program to sort N number of elements using bubble sort.
17. Write a program to sort N number of elements using quick sort.
18. Write a program to sort N number of elements using merge sort.
19. Write a program to sort N number of elements using selection Sort.
20. Write a program to sort N number of elements using insertion Sort.

BCA2302 RDBMS

CODE	SUBJECT NAME	PREREQUISITE	COURSE TYPE	CREDIT	L-T-P
BCAC2302	RDBMS	NIL	THEORY+ PRACTICE	6	4-0-3

MODULE I:

Introduction to Database Systems and File Based Systems: Database Systems, Common uses of Database Systems, File Based Approach, Limitations of File Based Approach, File-oriented Systems vs. Database Systems (Most of the topics will be through power point presentation; Demonstration of File oriented System and Database System)

Database Approach: Database, Database Management System (DBMS), Database Application Programs, Components of DBMS Environment, Advantages and Disadvantages of DBMS. (Most of the topics will be through power point presentation)

Roles in Database Environment: Data and Database Administrators (DBA), Database Designers, Application Developers, End-Users. (Most of the topics will be through power point presentation)

MODULE-II:

Database System Architecture: Three Level Architecture, External Level, Conceptual Level, Internal Level, Schemas, Mappings, and Instances, Data Independence, Data Abstraction, (Most of the topics will be through power point presentation)

Database Languages: Data Definition Language (DDL), Data Manipulation Language (DML). (Most of the topics will be through power point presentation.)

Data Models and Conceptual Modelling: Data models, E-R models, Relational models, Network and Object Oriented Data models, Mapping E-R model to Relational model. (Most of the topics will be through practice mode)

Normalization: Normal forms: 1NF, 2NF, 3NF (Most of the topics will be through practice mode)

MODULE –III:

Terminologies of Relational Model: Relational Data Structure, Mathematical Relations, Database Relations, Properties of Relations, Relational Keys, Representing Relational Database Schema.

Integrity Constrains and Views: Nulls, Entity Integrity, Referential Integrity, General Constraints, Views, Purpose of Views.

SQL: Introduction: Objectives of SQL, Writing SQL Command. SQL: Data Definition: Data Definition, Creating a Database, Table Operations (Create, Alter, and Drop), Creating an Index, Removing an Index. SQL: Data Manipulation: Simple Queries, Sorting Results (Order By), Aggregate Functions, Join, Grouping Results (Group By) Query-By-Example: Introduction to QBE, Building Select queries using QBE.

TEXT BOOKS:

1. Database Systems By Thomas M. Connolly and Carolyn E. Begg – Pearson Education-4th, edition (Chapters: 1, 2, 3, 5, 6, 7.1, 7.2, 11, 13)
2. Fundamentals of Database System By Elmasari & Navathe – Pearson Education-5th, Edition.

REFERENCE BOOKS:

1. An introduction to Database System – Bipin Desai, Galgotia Publications
2. Database System: concept, Design & Application – S.K.Singh (Pearson Education)
3. Fundamentals of Database Management System – Gillenson, Wiley India

PRACTICAL

1. Introduction to Database and Database languages.
2. Use of SQL syntax: insertion, deletion using SQL.
3. Use of SQL syntax: updation, modification using SQL.
4. Programs on join statements and SQL queries including where clause.
5. Programs on procedures and functions.
6. Programs on database triggers.
7. Programs on packages.
8. Programs on data recovery using check point technique.
9. Concurrency control problem using lock operations.
10. Programs on JDBC and ODBC using database.

BCA2303 Fundamentals Of Algorithm Design And Analysis

CODE	SUBJECT NAME	PREREQUISITE	COURSE TYPE	CREDIT	L-T-P
BCAC2303	Fundamentals Of Algorithm Design And Analysis	NIL	Theory	6	5-1-0

MODULE-I

Introduction to analysis and design of algorithm, Growth of functions, Asymptotic notations, Recurrences, Solution of recurrences by substitution, Recurrence tree and the master method. Divide and conquer algorithms (Worst case analysis of merge sort, quick sort and heap sort algorithms), Priority queue, Data structure for disjoint sets (Disjoint set operations, linked list representation, disjoint set forests)

MODULE-II

Dynamic programming approach: Matrix chain multiplication, longest common subsequence. Greedy method: Fractional knapsac problem Greedy verses dynamic programming, Huffman codes. Concept of backtracking, branch & bound design techniques. Graph algorithms: Minimal spanning tree (Kruskal and Prim’s algorithms), Single source shortest paths (Bellman-Ford and Dijkstra’s algorithm), Floyd’s algorithm.

MODULE –III

Flow Network, Ford-Fulkerson method, Fast Fourier Transform, Rabin-Karp string matching algorithm. NP-Completeness, Polynomial time solvability, Verification and Reducibility, NP complete problems (without proof), Approximation algorithm for the traveling salesman problem.

Text book:

1. T.H. Cormen, C.E. Leiserson, R.L. Rivest and L.Stein, “Introduction to Algorithms” , Second Edition, PHI Learning, 2002
Chapters: 1, 2, 3, 4(excluding 4.4), 6, 7 (7.4.1), 15(15.2, 15.3. 15.4), 16(16.1, 16.2, 16.3), 21(21.1, 21.2, 21.3) 23, 24(24.1, 24.2, 24.3), 26(26.1, 26.2), 30(30.1, 30.2), 32(32.1, 32.2), 34, 35(35.2)

Reference books:

1. E. Horowitz, S. Sahani, S. Rajsekharan, ”Fundamentals of Computer Algorithms”, Second Edition, Universities Press, 2007
2. J. Kleinbers, E.Tardos, Algorithm design, Pearson Education Inc., New Delhi , 2006
3. R. Johnsonbaugh, M. Schaefer, “Algorithms”, Pearson Education Inc., New Delhi , 2004
4. Kenneth A. Berman & Jerome L. Paul, “Algorithms”, Revised Edition, 2005, CENGAGE

Learning India Pvt. Ltd., New Delhi.

5. Anany V. Levitin, "Introduction to the Design and Analysis of Algorithms", Second Edition, 2007, Pearson Education Inc., New Delhi.

6. Michael T. Goodrich and Roberto Tamassia, "Algorithm Design: Foundations, Analysis, and Internet Examples", 2nd Edition, Wiley India Pvt. Ltd., New Delhi

BCAS2001 Computer Hardware and Maintenance (0+0+3)

CODE	SUBJECT NAME	PREREQUISITE	COURSE TYPE	CREDIT	L-T-P
BCAS2001	Computer Hardware And Maintenance	NIL	THEORY+ PRACTICE	4	2-0-3

MODULE I (15 HRS)

Computer System, Cases, Power Supplies, Internal Components, Ports and Cables, Input and Output devices, System Resources.

Safety Guidelines: ESD, MSDS, Hardware Tools: ESD Tools, Hand tools, Cleaning tools, Diagnostic tools.

Software Tools: Fdisk, chkdsk, defrag, disk cleanup, SFC, Antivirus program, Spyware remover, firewall

Step by Step Computer Assembly.

MODULE II (20 HRS)

Preventive maintenance and troubleshooting process, purpose of data protection, gathering details from customer, verifying obvious issues, gathering data from computers, quick solutions, closing with the customer.

Installing an OS, OS: purpose, limitation, compatibility, common preventive maintenance techniques, Troubleshooting an OS

Laptops, PDAs and Smartphones, Common preventive maintenance techniques, Troubleshooting Laptops and portable devices.

Printers and scanners: Different types, installation and configuration process, working of laser printer, common preventive techniques, Troubleshooting printers and scanners.

MODULE III (15 HRS)

NETWORKING: Types of networks, LAN, WAN, WLAN, Basic networking concepts and technologies, Physical components of a network, LAN Topologies, Standard Organization, Ethernet Standards, OSI and TCP/IP data models, Configuring a NIC, Modem, Other technologies to establish connectivity, Troubleshooting a network

Network Security: Security Threats, Security procedures, Common Preventive Maintenance for security, Troubleshooting security.

TextBook:

1. IT Essentials, 4th Edition by Cisco Press

BCAS2002 Advance Linux Administration (0+0+3)

CODE	SUBJECT NAME	PREREQUISITE	COURSE TYPE	CREDIT	L-T-P
BCAS2002	ADVANCE LINUX ADMINISTRATION	NIL	PRACTICE	2	0-0-3

MODULE I (10 HRS)

Linux – The Operating System, Open Source Software, GNU, GNU Public License, Advantages of Open Source Software, Difference between Windows and Linux. Installing Linux, Hardware and Environmental Considerations, Server Design, Dual- Booting Issues, Methods of Installation, Installing Fedora.

MODULE II (20 HRS)

Common Commands, Clocks, Daemons, Hardware, Host Information, Installation, Mail, Managing File systems, Managing the Kernel, Networking, Printing, Security and system Integrity, Starting and Stopping the System, System Activity and Process Management, Users, Miscellaneous. Overview of Networking – TCP/IP Administration, NFS and NIS Administration.

MODULE III (20 HRS)

Boot Methods – The Boot Process, LILO, GRUB, Dual-Booting Linux and Windows XP/Vista, Boot-Time Kernel Options. The Bash Shell – Features, Invoking the Shell, Syntax, Functions, Variables, Arithmetic Expressions, Command History, Job Control, Command Execution, Restricted Shells, Built-in Commands

Text Book:

1. Ellen Siever, Stephen Figgins, Robert Love, Arnold Robbins, “Linux in a Nutshell”, O’ Reilly.
2. Wale Soyinka, “Linux Administration: A Beginner’s Guide”, McGraw Hill Companies.

BCAS2003 PHP PROGRAMMING (0+0+3)

CODE	SUBJECT NAME	PREREQUISITE	COURSE TYPE	CREDIT	L-T-P
BCAS2003	PHP PROGRAMMING	NIL	PRACTICE	2	0-0-3

MODULE I (15 HRS)

Introduction to PHP: Basic Syntax, Variable, Constant, data type, Operator and expression
HTML Form: Capturing form data, multi value field, generating file upload form, redirecting a form after Submission, making decisions, loops

MODULE II (15 HRS)

Function, String handling functions, Array, Library functions, files and directories, Opening and closing a file Coping, renaming and deleting a file, file uploading and downloading

MODULE III (20 HRS)

Hidden field, Cookies, Session, String Matching, Pattern Matching, Replacing Text, Splitting a string with a regular expression. Creating and manipulating images, Using text in image.

TextBook:

1. PHP: A Beginner's Guide – by Vikram Vaswani

Reference:

1. Learning PHP, MySQL, JavaScript, and CSS: A Step-by-Step Guide to Creating Dynamic Websites – by Robin Nixon

BCAS2004 Programming With Visual Basics in Visual Studio .NET (0+0+3)

CODE	SUBJECT NAME	PREREQUISITE	COURSE TYPE	CREDIT	L-T-P
BCAS2004	Programming With Vb In .Net	NIL	PRACTICE	2	0-0-3

MODULE I (15 HRS)

Introduction to Visual Basic, IDE and its Components, VB Data type, Variable Scope, Module, Conditional Statement, Looping, Procedure, Function, Event, Forms Controls (Property, Event, Method) Control Array, Dialogbox (MsgBox (), InputBox()), MDI form, Menu (Standard Module, MDI).

MODULE II (15 HRS)

Introduction to Activex control, Common Dialog Control, File Operation. Draw (Line, Circle, Box, Ellipse), Animations, Graphical Command Button

MODULE III (20 HRS)

Introduction to Database, Bound Control and UnBound Control, Recordset, Types of Connectivity (DAO, RDO, ADO), Introduction to Data Report, Design Data Report, Group Report.

Text Books

1. Mastering Visual Basic – Evangelos petroustos - BPB Publication
2. Visual Basic – Garry Coprnell –Tata McGraw-Hill.

Generic Elective (GE)-3

Credits- 6

- Students can choose a generic elective from other discipline.

Semester: IV

BCAC2401 Programming In C++ (4+0+3)

CODE	SUBJECT NAME	PREREQUISITE	COURSE TYPE	CREDIT	L-T-P
BCAC2401	Programming In C++	Programming In C	Theory + Practice	6	4-0-3

MODULE-1 Introduction to OOPs and C++ Element – 20 Hrs

Introduction to OOPs, Features & Advantages of OOPs, Different element of C++ (Tokens, Keywords, Identifiers, Variable, Constant, Operators, Expression, String).

Sequential Constructs, Decision Making Construct, Iteration / Loop Construct, Arrays, Functions (User defined Function, Inline Function, Function Overloading), User Defined Data Types (Structure, Union and Enumeration).

MODULE – 2 Class, Object, Constructor & Destructor – 20 Hrs

Class, Modifiers (Private, Public & Protected), Data Member, Member Function, Static Data Member, Static Member Function, Friend Function, Object, Constructor (Default Constructor, Parameterized Constructor and Copy Constructor), Destructor.

Pointer (Pointer to Object, this Pointer, Pointer to Derive Class), Introduction to Polymorphism (Runtime Polymorphism, Compiletime Polymorphism), Operator Overloading, Virtual Function, Inheritance (Single Inheritance, Multiple Inheritance, Multilevel Inheritance, Hierarchical Inheritance, Hybrid Inheritance), Virtual Base Class, Abstract Class.

MODULE – 3 File Handling, Exception Handling – 10 Hrs

Files I/O, Exception Handling (Exception Handling Mechanism, Throwing Mechanism, Catching Mechanism, Re-throwing an Exception).

Text Books:

1. E. Balguruswamy, “Object Oriented Programming with C++”, TMH Publisher.
 2. A.N. Kamthane, “Object Oriented Programming with ANSI & Turbo C++”, Pearson Education
- Reference Books:**
3. Behrouz A. Forouzan & Richard F. Gilberg “A Structured approach using C++” Cengage Learning Indian Edition.
 4. Bjarne Stroustrup, “C++ Programming Language”, Pearson Education,
 5. Object-Oriented Programming with ANCI & TURBO C++ : Kamthane

PRACTICAL

1. WAP to print the sum and product of digits of an integer.
2. WAP to reverse a number.
3. WAP to compute the sum of the first n terms of the following series
$$S = 1 + 1/2 + 1/3 + 1/4 + \dots$$
4. WAP to compute the sum of the first n terms of the following series
$$S = 1 - 2 + 3 - 4 + 5 - \dots$$
5. Write a function that checks whether a given string is Palindrome or not. Use this function to find whether the string entered by user is Palindrome or not.
6. Write a function to find whether a given no. is prime or not. Use the same to generate the prime numbers less than 100.
7. WAP to compute the factors of a given number.
8. Write a macro that swaps two numbers. WAP to use it.

9.WAP to print a triangle of stars as follows (take number of lines from user):

*

10. WAP to perform following actions on an array entered by the user:
- i) Print the even-valued elements
 - ii) Print the odd-valued elements
 - iii) Calculate and print the sum and average of the elements of array
 - iv) Print the maximum and minimum element of array
 - v) Remove the duplicates from the array
 - vi) Print the array in reverse order
- The program should present a menu to the user and ask for one of the options. The menu should also include options to re-enter array and to quit the program.
11. Create Matrix class using templates. Write a menu-driven program to perform following Matrix operations (2-D array implementation):
- i) Sum b) Difference c) Product d) Transpose
12. Create the Person class. Create some objects of this class (by taking information from the user). Inherit the class Person to create two classes Teacher and Student class. Maintain the respective information in the classes and create, display and delete objects of these two classes (Use Runtime Polymorphism).
13. Create a class Triangle. Include overloaded functions for calculating area. Overload assignment operator and equality operator.
14. Create a class Box containing length, breath and height. Include following methods in it:
- i) Calculate surface Area
 - ii) Calculate Volume
 - iii) Increment, Overload ++ operator (both prefix & postfix)
 - iv)Decrement, Overload – operator (both prefix & postfix)
 - v) Overload operator == (to check equality of two boxes), as a friend function
 - vi) Overload Assignment operator
 - vii) Check if it is a Cube or cuboid
- Write a program which takes input from the user for length, breath and height to test the above class.
15. Create a structure Student containing fields for Roll No., Name, Class, Year and Total Marks. Create 10 students and store them in a file.
16. Write a program to retrieve the student information from file created in previous question and print it in following format:
 Roll No. Name Marks
17. Copy the contents of one text file to another file, after removing all whitespaces.
18. Write a function that reverses the elements of an array in place. The function must accept only one pointer value and return void

BCAC2402 Operating System Concepts (4+0+3)

CODE	SUBJECT NAME	PREREQUISITE	COURSE TYPE	CREDIT	L-T-P
BCAC2402	OPERATING SYSTEM CONCEPTS	NIL	THEORY + PRACTICE	6	4-0-3

MODULE-I (20 Hours)

INTRODUCTION TO OPERATING SYSTEM:

What is an Operating System? Simple Batch Systems, Multiprogramming and Time Sharing systems Parallel Systems, Distributed Systems and Real time Systems.

Operating System Structures: Operating System Services, System components, Protection system, Operating System Services, system calls.

PROCESS MANAGEMENT:

Process Concept, Process Scheduling, Operation on Processes, Inter-process communication, Examples of IPC Systems, Multithreading Models, Threading Issues, Process Scheduling Basic concepts, scheduling criteria, scheduling algorithms, Thread Scheduling.

MODULE-II (20 Hours)

PROCESS COORDINATION: Synchronization: The Critical section problem, Peterson's solution, Synchronization hardware, Semaphores, Classical problems of synchronization.

Deadlocks: System model, Deadlock Characterization Methods for Handling Deadlocks, Deadlock Prevention, Deadlock avoidance, Deadlock Detection, recovery from Deadlock.

MEMORY MANAGEMENT: Memory Management strategies, Logical versus Physical Address space, swapping, Paging, Segmentation.

Virtual Memory: Background, Demand paging, performance of Demand paging, Page Replacement, Page replacement algorithms. Allocation of frames, Thrashing, Demand Segmentation.

MODULE-III (10 Hours)

STORAGE MANAGEMENT:

File System Concept, Access Methods, File System Structure, File System Structure, File System Implementation, Directory implementation, Efficiency and Performance, Recovery, Overview of Mass Storage Structure, Disk Structure, Disk Scheduling, Disk Management, Swap-Space Management.

CASE STUDIES: The LINUX System, Windows XP, UNIX system.

TEXT BOOK:

1. Operating System Concepts – Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, 8th edition, Wiley-India, 2009.
2. Modern Operating Systems – Andrew S. Tanenbaum, 3rd Edition, PHI
3. Operating Systems: A Spiral Approach – Elmasri, Carrick, Levine, TMH Edition

REFERENCE BOOK:

1. Operating Systems – Flynn, McHoes, Cengage Learning
2. Operating Systems – Pabitra Pal Choudhury, PHI
3. Operating Systems – William Stallings, Prentice Hall
4. Operating Systems, - Rohit Khurana, 1st Edition, Vikas Publishing House Pvt Ltd.

PRACTICAL

1. Detail anatomy of Operating System.
2. Basic DOS Commands and its Use.
3. Basic UNIX / LINUX commands and its Use.
4. Study of different editors in LINUX (vi, gedit, etc.)
5. Detail study of File Access Permission in LINUX.
6. Simulation of CPU Scheduling Algorithms. (FCFS, RR, SJF, Priority, Multilevel Queuing).
7. Simulation of Banker's Algorithm for Deadlock Avoidance, Prevention.
8. Program for FIFO, LRU, and OPTIMAL page replacement algorithm.

BCAC2403 Computer Communication And Networking (4+0+3)

CODE	SUBJECT NAME	PREREQUISITE	COURSE TYPE	CREDIT	L-T-P
BCAC2403	Computer Communication And Networking	NIL	THEORY + PRACTICE	6	4-0-3

MODULE-I (15 HRS)

Overview of Computer Networks:

Introduction: OSI, TCP/IP and other networks models, Examples of Networks: Novell Networks, Arpanet, Internet, Network Topologies WAN, LAN, MAN.

Physical Layer: Transmission mode, Transmission Media: Guided Media, Unguided media (wireless), Multiplexing: FDM, WDM, TDM, Circuit switching and Telephone Network: Circuit switching, Telephone network.

MODULE-II (15 HRS)

Data link layer: Design issues, framing, error detection and correction, CRC, Elementary Protocol-stop and wait, Sliding Window, Data link layer in HDLC, ATM.

Point-to –Point Access: PPP, Multiple Access Protocols: Random Access, Controlled Access, Channelization.

Local area Network: Ethernet.

Wireless LANs: IEEE 802.11, Bluetooth virtual circuits

MODULE-III (20 HRS)

Network Layer : addressing and Network Layer Protocols: ARP, IPV4, ICMP, IPV6 ad ICMPV6, Broad cast, Multi cast, Congestion, Control Algorithms – General Principles of Congestion prevention policies. Internetworking: The Network layer in the internet and in the ATM Networks.

Transport Layer: Process to Process Delivery: UDP; TCP congestion control.

Application Layer:

Client Server Model, Domain Name System (DNS): Electronic Mail (SMTP) and file transfer (FTP) HTTP and WWW.

Text Books:

1. Data Communications and Networking: Behrouz A. Forouzan, Tata McGraw-Hill, 4thEd
3. Computer Networks: A. S. Tannenbum, D. Wetherall, Prentice Hall, Imprint of Pearson 5thEd

Reference Book : .

1. Computer Networks:A system Approach:Larry L, Peterson and Bruce S. Davie,Elsevier, 4thEd
2. Computer Networks: Natalia Olifer, Victor Olifer, Willey India
3. An Engineering Approach to Computer Networks-S.Keshav, 2nd Edition, Pearson Education
4. Computer Networking: A Top-Down Approach Featuring the Internet, James F. Kurose and Keith W. Ross , 2nd Edition, Pearson Education, 2002.

PRACTICAL

Some Network protocol simulation using NetSim, NS2, etc. for

1. Analysing bus vs. star-switch with respect to number of collisions (for a fixed number of transmitting nodes) for Ethernet LAN
- 2) Analysing number of transmitting nodes vs. collision count, mean delay for Ethernet LAN
- 3) Analysing performance of token ring with number of nodes vs. response time, mean delay using NetSim.
- 4) Comparing the throughput and normalized throughput for token ring and token bus for different transmitting nodes.
- 5) Comparing the CSMA/CD vs. CSMA/CA protocols (for a fixed number of transmitting nodes).

- 6) Analysing the difference between unicast and broadcast transmission (for a fixed number of transmitting nodes).
- 7) Verification of stop-and-wait protocol.
- 8) Verification of Go-back-N protocol.
- 9) Verification of Selective repeat protocol.
- 10) Verification of distance vector and link state routing algorithm.

Generic Elective (GE)-4

Credits- 6

- Students can choose a generic elective from other discipline.

Course Structure under CBCS – III Year

<i>III Year Semester 5</i>				<i>III Year Semester 6</i>			
<i>Subject Code</i>	<i>Subject Name</i>	<i>L+T+P</i>	<i>Credits</i>	<i>Subject Code</i>	<i>Subject Name</i>	<i>L+T+P</i>	<i>Credits</i>
	SEC - 1	0+0+3	2		SEC - 2	0+0+3	2
BCAC3501	Introduction to Data Structure	4+0+3	6	BCAC3601	Programming in C++	4+0+3	6
BCAC3502	RDBMS	4+0+3	6	BCAC3602	Operating System Concepts	4+0+3	6
DSE - 1	Subject Specific		6	DSE – 3	Subject Specific		6
DSE - 2	Subject Specific		6	DSE - 4	Subject Specific		6
<i>Total Semester Credits</i>			26	<i>Total Semester Credits</i>			26
<i>Total Cumulative Credits</i>			66	<i>Total Cumulative Credits</i>			92

Discipline Specific Elective Courses (04 papers) (Credit: 06 each)- DSE 1 to DSE 4

Sl No	Subject Code	Subject Name	Subject Type (L+T+P)	Credits
1	BCAD3001	Programming using python	4+0+3	6
2	BCAD3002	Cryptography and Network Security	5+1+0	6
3	BCAD3003	Cyber Crime and Law	5+1+0	6
4	BCAD3004	Principles of MIS	5+1+0	6
5	BCAD3005	Data Mining and Ware Housing	5+1+0	6
6	BCAD3006	Enterprise Resource Planning	5+1+0	6
7	BCAD3007	Dissertation/ Project	5+1+0	6

Semester: V

BCAC3501 Internet And Web Technology (4+0+3)

CODE	SUBJECT NAME	PREREQUISITE	COURSE TYPE	CREDIT	L-T-P
BCAC3501	Internet And Web Technology	NIL	THEORY + PRACTICE	6	4-0-3

MODULE-I (20 HRS)

Introduction to the Internet and the World Wide Web, WebPages; Hyper Text Transfer Protocol (HTTP); File Transfer Protocol (FTP) Domain Names; URL; Website, Web browser, Web Servers; Web Hosting.

HTML

Introduction, Objectives, Introduction to Universal Resource Identifier (URI),

History of HTML,

Structure of HTML Basic Tags of HTML, Planning for designing Web pages, Model and structure for a Website, Developing Websites,.

Tag;

Creating Links: Link to other HTML documents and same HTML documents.

List, Tables: Creating Tables, Frames, Forms.

MODULE- II (20 HRS)

JAVA Script

JavaScript: Introduction to Scripting, JavaScript: Control Statements, JavaScript: Functions,

JavaScript: Arrays JavaScript: Objects.

CSS

External Style Sheets, Internal Style Sheets, Inline Style, The class selector, div & span tag

MODULE-III (10 HRS)

DOM

HTML DOM, XML: Introduction; Features of XML, Dynamic HTML (DHTML), DHTML form, XML DOM.

CGI/PERL

Introduction to CGI, Testing & Debugging Perl CGI Script.

Textbooks

1. Web Warrior Guide to Web Design Technologies, Don Gosselin, Joel Sklar& others, Cengage Learning

Reference Books

1. Web Programming: Building Internet Applications, Chris Bates, Wiley Dreamtech

2. Programming the World Wide Web, Robert W Sebesta, Pearson

3. Web Technologies, Uttam K Roy, Oxford

4. Web Technology: A developer perspective, Gopalan&Akilandeswari, PHI

Internet And Web Technology Lab

Describe the use and function of the following

i) HTTP ii) TELNET iii) FTP iv) SMTP

2. Create your first web page using HTML basic Tags.

3. Create a web page with the following constrains

I) an clickable image ii) a hyperlink to your collage web site

iii) a table of marks of B Sc class student.

4. Create your student web **Form** for the entry of Student's information.

5. Create a complete web page using Frame.

6. Validate the registration and user login in a web site using JavaScript.

7. Design a digital clock on your web page using Java script.

8. Basics of CGI scripting using Perl or C.

9. Design a digital calculator using HTML and Java script.

10. Create and save an XML document at the server, which contains 10 users information. Write a program which takes User Id as input and returns the user details by taking the user information from the XML document.

BCAC3502 Programming In Java (4+0+3)

CODE	SUBJECT NAME	PREREQUISITE	COURSE TYPE	CREDIT	L-T-P
BCAC3502	Programming In Java	NIL	THEORY + PRACTICE	6	4-0-3

MODULE I (15 HRS)

Introduction: Basic Concept of Object Oriented Programming: Object & Class, Data Abstraction & Encapsulation, Inheritance, Polymorphism, Dynamic Binding and Message Communication.

Evaluation of JAVA: features of JAVA. Java & Internet, Java Environment: JDK, JRE, JAVA Programming Structure, Implementing a JAVA Program. JVM, Constant Variable and Data type, Command Line Argument. Type Casting, Operator and Expression, Operator Precedence & Associativity. Decision making and Branching, Looping (While, do while, for).

MODULE II (15 HRS)

Classes and Object: Defining a class, Creating Object, Constructor, Method Overloading, Static Members, Inheritance, Method Overriding, Final Variable, final methods and Final Class, Garbage Collection & finalize () method, Abstract Method and Class, Visibility Control. Array, String, Vectors, Wrapper classes. Interfaces: Defining Interfaces, Extending Interfaces, Implementing Interfaces, Packages: Creating & Accessing Packages

MODULE III (20 HRS)

Exception Handling (try, catch, throw, throws, finally), Multithreading: Creating Threads, Thread Life Cycle, Thread Priorities, Synchronization, Inter Thread Communication, Applet Programming: Applet Life Cycle, Write & Running Applet Program. Managing Input and Output file: Stream classes, Byte Stream Classes & Character Stream Classes, Reading & Writing Files.

Text Book:

1. Programming with JAVA by E. Balagurusamy Tata McGraw - Hill Education
2. Core Java for Beginners, Rashmi Kanta Das, 3rd Edition Vikas Publishing House Pvt Ltd.

Reference Book:

1. Java complete Reference, Herbert Schildt
2. Big Java: Horstman, Willey India, 2nd Edition.
3. Java How to Program: H.M. Deitel & Paul J. Deitel, PHI, 8th Edition

PROGRAMMING IN JAVA LAB

1. Program using Command Line Argument
2. Programming with looping & Control structure
3. Programming with class and Object
4. Programming with Inheritance
5. Programming with Package
6. Programming with Intefaces
7. Programming with Exception Handling
8. Programming with Thread
9. Programming with Applet concept
10. Programming with the concept of File

Discipline Specific Elective Courses (04 papers) (Credit: 06 each)- DSE 1 to DSE 4

1. Programming using python
2. Cryptography and Network Security
3. Cyber Crime and Law
4. Principles of MIS
5. Data Mining and Ware Housing
6. Enterprise Resource Planning
7. Dissertation/ Project

Note: Colleges may include more options as per availability

BCAD3001 Programming Using Python (4+0+3)

CODE	SUBJECT NAME	PREREQUISITE	COURSE TYPE	CREDIT	L-T-P
BCAD3001	Programming Using Python	NIL	THEORY + PRACTICE	6	4-0-3

MODULE-I (15 Hours)

Overview: Environment, Basic Syntax, Variable Types, Basic Operators, Installing Python. Very Simple Programs

MODULE-II (15 Hours)

Scripts Loops, Conditionals Functions. Tuples, Lists, Dictionaries for Loop, Classes Importing Modules, File I/O Error Handling.

MODULE-III (20 Hours)

Loop , Loop Control. Numbers, Strings, Lists, Tuples, Dictionary, Date & Time. Functions, Modules, Files I/O, Exceptions. Classes / Objects, Reg Expressions, GUI Programming.

Text Books:

1. Programming Python: Powerful Object Oriented Programming; Mark Lutz; Shroff/O'Reilly;2010.
2. Beginning Python: Using Python 2.6 & Python 3.1; James Payne; Wiley India; 2011.
3. Head First Programming: A Learner's Guide to Programming using Python Language; Barry & Griffiths; Shroff/O'Reilly; 2009.

BCAD3002 Cryptography And Network Security (5+1+0)

CODE	SUBJECT NAME	PREREQUISITE	COURSE TYPE	CREDIT	L-T-P
BCAD3002	Cryptography And Network Security	NIL	THEORY	6	5-1-0

MODULE-I (20 Hours)

Security and Cryptographic algorithm: Need for security, principle of security, types of attacks. Cryptographic techniques : cryptography terminology, substitution techniques, transposition techniques, Symmetric and asymmetric key algorithm, possible types of attack, key range, steganography. Symmetric vs asymmetric, algorithm types and modes, DES, double and triple DES, AES, comparison of various cryptographic algorithm, requirement of good cryptographic algorithm.

MODULE-II (20 Hours)

Asymmetric cryptographic algorithm and Message Authentication: Public key cryptography principles and algorithms, RSA algorithm, Diffe-Hellman key exchange. One way hash functions, message digest, MD5, SHA1, message authentication code, Digital envelope, Digital signatures.

MODULE-III (10 Hours)

Network security: Overview of IPV4: OSI model, maximum transfer unit, IP, TCP, UDP, ICMP, ARP, RARP and DNS, ping, traceroute. Network attacks: Buffer overflow, IP scheduling, TCP session hijacking, sequence guessing. Network scanning: ICMP, TCP sweeps, basic port scans. Denial of service attacks: SYN flood, teardrop attacks, land, smurf attacks.

TEXT BOOK:

1. William Stallings: Network Security Essentials

REFERENCE BOOK:

1. Cryptography and Network Security by forouzan

BCAD3003 Cyber Crime And Law (5+1+0)

CODE	SUBJECT NAME	PREREQUISITE	COURSE TYPE	CREDIT	L-T-P
BCAD3003	Cyber Crime And Law	NIL	THEORY	6	5-1-0

MODULE-I (15 HRS)

Cyber crime: Definition – History and evolution Types and forms of cyber crimes –Malicious Code – Computer Viruses ,Computer Worms ,Computer Trojans, Web Hacking Foot printing, Port Scanning, E-Shoptlifting Web Defacement, Denial of Service Attacks, Manipulating Cookies - Email Hacking: Email Hacking using Packet Sniffers, Email Hacking & Phishing, Email Frauds & Phishing, Email Bombing Email Hijacking - Social Engineering .

MODULE- II (15 HRS)

Best Practices for Cyber Crime Investigation: Initialising a Search and Seizure Operation Tracking & Tracing Emails, Recovery of Digital Evidence, Setting up a Cyber Crime Investigation Cell Cyber Forensics: Basic Forensic Principles, Forensic Imaging & Verification, Data Recovery and Analysis

MODULE- III (20 HRS)

Cyber terrorism Prevention and detection of cyber crime – Cyber Policing Current statutes in India: Penalties & Offences under the Information Technology Act, 2000, Offences under the Indian Penal Code, 1860, Issues relating to investigation and adjudication of cyber crimes in India Digital evidence IT act 2000 and other legal provisions Intellectual Property Issues and Cyberspace – The Indian Perspective: Overview of Intellectual Property related Legislation in India, Copyright law & Cyberspace Trademark law & Cyberspace. Digital Delivery of Intellectual Property Services

TextBook:

1. Text book on Cyber law by Pavan Duggal, Universal Law publishing

References:

1. Understanding Laws- Cyber laws and cyber crimes by GarimaTiwari
2. Cyber Laws &Cyber crimes by DivyaRohatgi, Law Arati Book
3. Information security and Cyber laws by Pankaj Sharma, S.K.Kataria& Sons

BCAD3004 Principles Of MIS (5+1+0)

CODE	SUBJECT NAME	PREREQUISITE	COURSE TYPE	CREDIT	L-T-P
BCAD3004	Principles Of MIS	NIL	THEORY	6	5-1-0

MODULE-I (15 HRS)

Fundamentals of Information Systems, Systems approach to problem solving, Developing information system solutions, Levels of MIS (Top, Middle, Lower). Corporate Databases & Database Management, Data Organization, Data models, Data Security & Information quality.

MODULE- II (15 HRS)

Transaction Processing Systems, Executive Information Systems, Decision Support Systems, Expert Systems, Information Systems in Marketing, Manufacturing, HRM, Accounting and Finance.

MODULE- III (20 HRS)

Information Resource Management, Planning Implementing & Controlling Information Systems, Computer Crime, Ethics & Society.

TextBook:

1. Brein James O. – Management Information Systems

References:

1. Murdick & Ross – Information Systems for Modern Management
2. Parker C.S. – Management Information Systems – Strategy and Action.
3. Aktas A.Ziya – Structured Analysis and Design of Information Systems.

BCAD3005 Data Mining And Ware Housing (5+1+0)

CODE	SUBJECT NAME	PREREQUISITE	COURSE TYPE	CREDIT	L-T-P
BCAD3005	Data Mining And Ware Housing	RDBMS	THEORY	6	5-1-0

MODULE I (15 HRS)

Data Warehousing : Data warehousing Components, Building a Data warehouse, Mapping the Data Warehouse to a Multiprocessor Architecture, DBMS Schemas for Decision Support, Data Extraction, Cleanup, and Transformation Tools, Metadata.

Business Analysis: Reporting and Query tools and Applications, Tool Categories, The Need for Applications, Online Analytical Processing (OLAP), Need, Multidimensional Data Model, OLAP Guidelines, Multidimensional versus Multirelational OLAP, Categories of Tools, OLAP Tools and the Internet.

MODULE II (20 HRS)

Data Mining: Introduction, Data, Types of Data, Data Mining Functionalities, Interestingness of Patterns, Classification of Data Mining Systems, Data Mining Task Primitives, Integration of a Data Mining System with a Data Warehouse, Issues, Data Preprocessing.

Mining Frequent Patterns, Associations and Correlations, Mining Methods, Mining various Kinds of Association Rules, Correlation Analysis, Constraint Based Association Mining, Classification and Prediction, Basic Concepts, Decision Tree Induction, Bayesian Classification, Rule Based Classification, Classification by Back propagation, Support Vector Machines, Associative Classification, Lazy Learners, Other Classification Methods, Prediction.

MODULE III (15 HRS)

Cluster Analysis , Types of Data, Categorization of Major Clustering Methods, K-means, Partitioning Methods, Hierarchical Methods, Density Based Methods, Grid Based Methods, Model-Based Clustering Methods, Clustering High Dimensional Data, Constraint – Based Cluster, Data Mining Applications.

TextBook:

1. Data Mining and Warehousing by S. Prabh

Reference:

1. Data Mining and Data Warehousing by Gunjan Goswami.

BCADc006 Enterprise Resource Planning (5+1+0)

CODE	SUBJECT NAME	PREREQUISITE	COURSE TYPE	CREDIT	L-T-P
BCAD3006	Enterprise Resource Planning	NIL	THEORY	6	5-1-0

MODULE I (15 HRS)

Overview of business function: Business function in an organization, material management , scheduling , shop floor control, forecasting, accounting and finance, human resources, productivity management, typical business processes, core processes, product control, sales order processing, purchases, administrative process, support processes, marketing strategic planning.

MODULE II (20 HRS)

Problems in traditional functional view, need for integrated process views, information as a resource, motivation for erp. Evolution of information systems: EDP Systems, MIS, Executive information systems, Information needs of organization, ERP as an integrator of information needs at various levels, Decision making at the above level.

MODULE III (15 HRS)

ERP Models/Functionality: Sales order purchasing, MRP scheduling, forecasting, maintenance, distribution, finance features of each of the model, description of data flows across each module, overview of supporting databases, technologies required for ERP.

TextBook:

4. V.K. Garg and N.K. Venkitakrishnan Enterprise Resource Planning Practices Prentice Hall

Recommended Books:

1. J. Kanter, Managing with information Prentice Hall(I) 1996 New Delhi
2. S Sadagopan Management Information System Prentice Hall(I) 1996 New Delhi
3. V.Rajaraman, Analysis and Design of information system Prentice Hal(I) 11997
4. K.M. Hussain and D. Hussain, Information System: Analysis Design and Implemetation, Tata McGraw Hill 1995 New Delhi

BCAD3007 DISSERTATION/ PROJECT

CODE	SUBJECT NAME	PREREQUISITE	COURSE TYPE	CREDIT	L-T-P
BCAD3007	DISSERTATION/ PROJECT	ANY PROGRAMMING LANGUAGE	PRACTICE	6	0-0-9

Semester: VI

BCAC3601 Introduction to Software Engineering (5+1+0)

CODE	SUBJECT NAME	PREREQUISITE	COURSE TYPE	CREDIT	L-T-P
BCAC3601	Introduction to Software Engineering	NIL	THEORY	6	5-1-0

MODULE –I

Process Models: Software Processes, Software Development Life Cycle Models, Waterfall Model, ‘V’ Model, Prototyping Model, the Iterative Waterfall Model, the Spiral Model.

Software Requirement Engineering: Requirement Engineering Process, Requirement Inception, Identification of Stakeholders, Requirement, And Requirement Elaboration: User Requirements.

MODULE –II

Structured Analysis & Design: Introduction to Structured Analysis, Data Flow Diagram, Process Specification, Entity Relationship Model, Structured Design Methodologies: Coupling and Cohesion, Software Testing: Testing Fundamentals, Verification & Validation, Black Box Testing, White Box Testing, Unit Testing, Integration Testing,

Object Oriented Testing, System Testing, Usability Testing

MODULE –III

Software Metrics- Software Metrics and its Classification, Software Size Metrics: LOC Metrics, Function Point Metrics, Feature Point Metrics, Process Metrics, Design Metrics: High Level Design Metrics, Component Level Design Metrics Object Oriented Metrics: CK Metrics Suite, Metrics for Object Oriented Design (MOOD) Project Estimation Techniques, COCOMO Model: Basic COCOMO Model, Intermediate COCOMO model, Complete COCOMO model

Textbooks

1. Software Engineering, Roger S Pressman, TMH
2. Fundamentals of Software Engineering, Rajib Mall, PHI

Reference Books

1. Software Engineering, Sommerville, Pearson
2. Software Engineering Fundamentals, Behforooz& Hudson, Oxford

BCAC3602 Dot Net Technology (4+0+3)

CODE	SUBJECT NAME	PREREQUISITE	COURSE TYPE	CREDIT	L-T-P
BCAC3602	Dot Net Technology	NIL	THEORY + PRACTICE	6	4-0-3

MODULE-I (15 HRS)

Introduction Vision and goals of .NET, Building blocks of .Net, overview of .Net applications, .Net evolution, The .Net Framework Architecture, Intermediate Language(IL), Common Language Runtime (CLR), JIT Compilation, Common Type System (CTS), Common Language System (CLS), Assemblies, IL Disassembler (ILDasm.exe), Namespaces. **C# features** Working with methods- understanding method structure, calling a method, understanding parameter types, overloading methods, virtual methods, overriding methods.

MODULE- II (15 HRS)

C# classes Constants, fields, methods, properties, events, indexers, operators, constructors, destructors, and static modifiers.

Class Inheritance Compiling with multiple classes, virtual and override methods, abstract methods, sealed classes, Boxing and Unboxing, Working with namespaces, Understanding interfaces, handling exceptions.

Windows Applications Understanding Windows Forms Architecture, Windows controls: Common, Containers, Menus and Tool strips, Data, Reporting. Adding and using windows controls to the form.

MODULE- III (20 HRS)

Database programming with ADO.NET Understanding the Dataset classes and their relatives, Understanding OLEDB and SQL Server Support, Understanding common database operations using ADO.NET – Operations that don't return rows, Data operations that return single, row entities, data operations that affect single-row entities, data operations returning sets of rows, data operations affecting sets of rows, operations that return hierarchical Creating web applications with web forms [Asp.NET]Difference between ASP and ASP.Net, Defining a web application, ASP.NET architecture, ASP.net web forms, Code behind model, Validation controls in ASP.NET, Server controls and data binding, Grid view, data repeater, data list, Data binding in ASP.NET, Data source controls- sql data source, Data controls – grid view and details view, Login controls.

Text Book:

1. Jeff Ferguson, Brian Patterson, Jason Beres, *C# Programming Bible*, Wiley Publishing Inc., Reprint 2006.

Reference Books:

1. Jeff Prorise, *Programming .Net*, 2nd Edition, WP Publishers & Distributors Pvt. Ltd, 2009.

2. Kevin Hoffman & Jeff Gabriel, *Professional .Net Framework*, 1st Edition, Wrox Press Publishers, 2006.

PRACTICAL

1. To implement output parameter and reference parameter
2. To implement the concept of indexers
3. To implement the concept of sealed class
4. To implement the concept of namespace
5. To implement the concept of interfaces
6. To implement the concept of events
7. To implement exception handling
8. To design a calculator in windows form
9. To implement data controls in windows form
10. To implement validation controls in web form
11. To implement Data controls in web form
12. To implement SqlDataReader in ADO.NET
13. To implement Dataset object in ADO.NET

Discipline Specific Elective Courses (04 papers) (Credit: 06 each)- DSE 1 to DSE 4

1. Programming using python
2. Cryptography and Network Security
3. Cyber Crime and Law
4. Principles of MIS
5. Data Mining and Ware Housing
6. Enterprise Resource Planning
7. Dissertation/ Project

Note: Colleges may include more options as per availability