

DEPARTMENT OF COMPUTER ENGINEERING & APPLICATIONS

**GLA UNIVERSITY,
MATHURA (U.P.) INDIA**

COURSE STRUCTURE

Bachelor of Computer Applications (BCA)

Under

Choice Based Credit System (CBCS)

Credits Distributions

Sr. No.	Category	No. of Credits
1	Humanities and Social Sciences (HS)	20
2	Basic Sciences (BS)	14
3	Engineering Sciences (ES)	-
4	Professional Core (PC)	66
5	Professional Elective (PE)	20
6	Open Elective (OE)	-
7	Project Work (PW)	8
8	Mandatory Non Credit Courses (MNC) (4 Courses)	-
Total		128

First Semester

S. NO.	CODE	SUBJECT	TEACHING SCHEME			CREDITS	CONTACTS HRS/WK
			L	T	P		
1.	BCAC0001	Programming Logic Using 'C'	4	0	0	4	4
2.	BCAC0002	Fundamentals of Computer and IT	4	0	0	4	4
3.	BCAC0003	Introduction of Logical Circuit and Digital Design	3	1	0	4	4
4.	BELH0005	Remedial English	3	0	0	3	4
5.	BMAS0151	Mathematics -I	3	1	0	4	4
PRACTICALS							
6.	BCAC0800	Programming Lab	0	0	4	2	4
7.	BCAC0801	Information Technology Lab	0	0	2	1	2
8.	BCTH0101	Soft Skills -I	0	0	2	1	2
TOTAL			16	4	8	23	28

Second Semester

S. NO.	CODE	SUBJECT	TEACHING SCHEME			CREDITS	CONTACTS HRS/WK
			L	T	P		
1.	BCAC0004	Data Structures using 'C'	3	1	0	4	4
2.	BCAC0005	Fundamental of Database Management System	3	0	0	3	3
3.	BCAC0006	Fundamentals of Operating Systems	3	0	0	3	3
4.	BBAC0001	Management Concepts & Practices	3	2	0	4	4
5.	BMAS0152	Mathematics -II	3	1	0	4	4
PRACTICALS							
6.	BCAC0802	Data Structures using 'C' Lab	0	0	4	2	4
7.	BCAC0803	Database Management System Lab	0	0	4	2	4
8.	BCAC0804	Operating System Lab	0	0	2	1	2
9.	BELH0803	English in Practice	0	0	2	1	2
10.	BCTH0102	Soft Skills -II	0	0	2	1	2
Total			16	2	14	25	32

Program Core (Computer)

S. NO.	CODE	SUBJECT	TEACHING SCHEME				C R E D I T S	CO NT AC TS HR /W K	PRE- REQUISITES
			L	T	P	J			
THEORY									
1.	BCAC0001	Programming Logic Using 'C'	4	0	0	0	4	4	
2.	BCAC0002	Fundamentals of Computer and IT	4	0	0	0	4	4	
3.	BCAC0003	Introduction of Logical Circuit and Digital Design	3	1	0	0	4	4	
4.	BCAC0004	Data Structures using 'C'	3	1	0	0	4	4	
5.	BCAC0005	Fundamental of Database Management System	3	0	0	0	3	3	
6.	BCAC0006	Fundamentals of Operating Systems	3	0	0	0	3	3	
7.	BCAC0007	Object Oriented Programming	3	0	0	0	3	3	Programming using 'C'
8.	BCAC0008	Computer Organization & Architecture	3	1	0	0	4	4	Introduction of Logical Circuit and Digital Design
9.	BCAC0009	Introduction to Python	3	0	0	0	3	3	Programming using 'C'
10.	BCAC0010	System Design & Software Engineering	3	0	0	0	3	3	
11.	BCAC1011	Computer Networks & Communication	3	1	0	0	4	4	
12.	BCAC0012	Programming in Java	3	0	0	0	3	3	Object Oriented Programming using C++
13.	BCAC0013	GUI based Programming Using Visual Basic	2	0	0	0	2	2	Object Oriented Programming using C++
14.	BCAC0014	Web Technology	4	0	0	0	4	4	Object Oriented Programming using C++
Total			44	4	0	0	48	48	

S. NO.	CODE	SUBJECT	TEACHING SCHEME				C R E D I T S	CONT ACTS HR/W K	PRE- REQUISITES
			L	T	P	J			
PRACTICALS									
15.	BCAC0800	Programming Lab	0	0	4	0	2	4	
16.	BCAC0801	Information Technology Lab	0	0	2	0	1	2	
17.	BCAC0802	Data Structures using 'C' Lab	0	0	4	0	2	4	
18.	BCAC0803	Database Management System Lab	0	0	4	0	2	4	
19.	BCAC0804	Operating System Lab	0	0	2	0	1	2	
20.	BCAC0805	Object Oriented Programming Lab	0	0	4	0	2	4	Programming using 'C'
21.	BCAC0806	Python Programming Lab	0	0	4	0	2	4	Programming using 'C'
22.	BCAC0807	Programming in Java Lab	0	0	4	0	2	4	Object Oriented Programming using C++
23.	BCAC0808	Visual Basic Programming Lab	0	0	4	0	2	4	Object Oriented Programming using C++
24.	BCAC0809	Web Technology Lab	0	0	4	0	2	4	Object Oriented Programming using C++
Total			0	0	36	0	18	36	

Projects

S. NO.	CODE	SUBJECT	TEACHING SCHEME				C R E D I T S	CONT ACTS HR/W K	PRE- REQUISITES
			L	T	P	J			
PROJECTS									
29.	BCAJ0950	Mini Project 1	0	0	0	0	1	0	
30.	BCAJ0951	Mini Project 2	0	0	0	0	1	0	
31..	BCAJ0971	Major Project	0	0	0	0	6	0	
Total			0	0	0	0	8	0	

Program Elective Bouquet

S. NO.	CODE	SUBJECT	TEACHING SCHEME				C R E D I T S	C O N T A C T S H R / W K	PRE- REQUISITES
			L	T	P	J			
Bouquet 1									
THEORY									
1.	BCAE0001	Advanced Database Management System	3	0	0	0	3	3	DBMS
2.	BCAE0002	Enterprise Resource Planning	4	0	0	0	4	4	
3.	BCAE0003	Software Project Management	4	0	0	0	4	4	System Design & Software Engineering
4.	BCAE0004	Management Information System and E commerce	4	0	0	0	4	4	Fundamentals of Computer and IT
5.	BCAE0005	Digital Marketing & Transformation	3	0	0	0	3	3	Computer Network & Web Technology
Total			18	0	0	0	18	18	
PRACTICALS									
1.	BCAE0070	Advanced Database Management System Lab	0	0	2	0	1	2	DBMS
2.	BCAE0071	Digital Marketing & Transformation Lab	0	0	2	0	1	2	Computer Network & Web Technology
Total			0	0	4	0	2	4	

S. NO.	CODE	SUBJECT	TEACHING SCHEME				C R E D I T S	C O N T A C T S H R/ W K	PRE- REQUISITES
			L	T	P	J			
Bouquet 2									
THEORY									
1.	BCAE0101	Introduction to Artificial Intelligence	4	0	0	0	4	4	Data Structure Using 'C'
2.	BCAE0102	Software Testing	4	0	0	0	4	4	Software Engineering
3.	BCAE0103	Cyber Security	4	0	0	0	4	4	Computer Network
4.	BCAE0104	Data Mining & Warehousing	4	0	0	0	4	4	DBMS
5.	BCAE0105	Discrete Structure & Graph Theory	3	1	0	0	4	4	
6.	BCAE0106	Design and Analysis of Algorithms	3	1	0	0	4	4	Data Structure Using 'C'
Total			22	2	0	0	24	24	

S. NO.	CODE	SUBJECT	TEACHING SCHEME				C R E D I T S	C O N T A C T S H R/ W K	PRE- REQUISITES
			L	T	P	J			
Bouquet 3									
THEORY									
1.	BCAE1201	Programming in Advanced Java	3	0	0	0	3	3	Object Oriented Programming using C++
2.	BCAE0202	Introduction to Distributed System	4	0	0	0	4	4	Fundamentals of Operating Systems
3.	BCAE0203	Introduction to Cloud Computing	4	0	0	0	4	4	Computer Network
4.	BCAE0204	Introduction to Big Data	3	0	0	0	3	3	
5.	BCAE0205	Introduction to Internet of Things	4	0	0	0	4	4	Computer Organization & Computer Network
6.	BCAE0206	.Net Framework using VB.Net	3	0	0	0	3	3	Object Oriented Programming using C++
Total			21	0	0	0	21	21	
PRACTICALS									
1.	BCAE0270	Advanced Java Lab	0	0	2	0	1	2	Object Oriented Programming using C++
2.	BCAE0271	Introduction to Big Data Lab	0	0	2	0	1	2	
3.	BCAE0272	VB.Net Programming Lab	0	0	2	0	1	2	Object Oriented Programming using C++
Total			0	0	6	0	3	6	

Program Core of Basic Science

S. NO.	CODE	SUBJECT	TEACHING SCHEME				C R E D I T S	CONT ACTS HR/W K	PRE- REQUISITES
			L	T	P	J			
Bouquet 4									
THEORY									
1.	BMAS0151	Mathematics –I	3	1	0	0	4	4	
2.	BMAS0152	Mathematics –II	3	1	0	0	4	4	
3.	BMAS0153	Optimization Methods	3	1	0	0	4	4	
4.	BCHS0202	Environmental Studies	2	0	0	0	2	2	
Total			11	3	0	0	14	14	

Program Core of Humanities

S. NO.	CODE	SUBJECT	TEACHING SCHEME				C R E D I T S	C O N T A C T S H R/ W K	PRE- REQUISITES
			L	T	P	J			
Bouquet 5									
THEORY									
1.	BELH0005	Remedial English	3	0	0	0	3	3	
2.	BBAC0001	Management Concepts & Practices	4	0	0	0	4	4	
3.	BELH0006	Ethics & Values	2	0	0	0	2	2	
Total			9	0	0	0	9	9	
PRACTICALS									
1.	BELH 0803	English in Practice	0	0	2	0	1	2	
2.	BELH 0804	Effective Communication and Personality Development	0	0	2	0	1	2	
3.	BELH 0805	Professional Communication & Behavioral Grooming	0	0	2	0	1	2	
4.	BCTH 0101	Soft Skills –I	0	0	2	0	1	2	

5.	BCTH 0102	Soft Skills –II	0	0	2	0	1	2	
6.	BCTH 0103	Soft Skills –III	0	0	4	0	2	4	
7.	BCTH 0104	Soft Skills –IV	0	0	4	0	2	4	
8.	BCTH 0105	Soft Skills –V	0	0	4	0	2	4	
Total			0	0	22	0	11	22	

BCAC0001: PROGRAMMING LOGIC USING 'C'

Objective: This course is designed to provide a comprehensive study of the C programming language. It stresses the strengths of C, which provide students with the means of writing efficient, maintainable, and portable code. The nature of C language is emphasized in the wide variety of examples and applications and to learn and acquire art of computer programming. To know about some popular programming languages and how to choose Programming language for solving a problem.

Credits: 04

L-T-P: 4-0-0

Module No.	Content	Teaching Hours
I	<p>Introduction: History, Facilities, Concepts, Uses; Basic Program Structure, Header-Files, Comments; A Simple C program, Identifiers, Basic Data Types and Sizes, Constants, Variables, Arithmetic, Relational and Logical Operators, Increment and Decrement Operators, Conditional Operator, Bit-wise Operators, Assignment Operators, Expressions, Type Conversions, Conditional Expressions, Precedence and Order of Evaluation.</p> <p>Input-Output Functions: Data Input and Output getchar(), putchar(), scanf(), printf(), functions.</p> <p>Control Flow: If-Else, While, Do-while, Goto, For Statements, Nested Control Structures, Switch, Break, Continue Statements, Comma Operator.</p>	26
II	<p>Arrays & Functions: Arrays Defining, Processing Array, Introduction to Multidimensional Arrays; gets(), puts() functions, Functions Types, Parameters, Prototypes, Passing Arrays to Functions, Recursion, Passing Arguments to a Function by Value;</p> <p>Storage Classes: Automatic, External, Static, Register Variables in Single File Environment.</p> <p>Pointer: Usage of Pointers, Addresses and Types, Pointer and Address Arithmetic, Pointer Operations and Declarations, Using Pointers as Function Arguments (Call By Reference, Call By Value), Pointer Array Duality Strings Arrays of Pointers, Pointers to Functions, Concept of Dynamic Allocation of Memory, Pre-Processor Directives.</p> <p>Other Data Types: Structures, Member Accessing, Pointers to Structures, Structures and Functions, Arrays of Structures, Unions, Enumerations and Bit Fields, Typedef.</p> <p>File Handling: Introduction of File Handling, Modes of File Handling Uses of fopen(), fclose(), putc(), getc(), putw(), getw(), fscanf(), fprintf(), ferror() Functions.</p>	26

Text Book:

- Yashavant P. Kanetkar, (2016), "Let us 'C'", BPB Publication, 14th edition.

Reference Books:

- Peter Vander Linden, Schaum's, "Outline of theory and problems of programming with C", TMH.
- Peter Vander Linden, "Expert C programming", PHI.
- Balagurusamy E., "Computing Fundamentals and C Programming", TMH.

Outcome: A student who successfully completes the course will have the ability to:

- CO1. Analyze a given problem and develop an algorithm to solve the problem.
- CO2. Design, develop and test programs written in 'C'.
- CO3. Write, compile and debug programs in C language.
- CO4. Use different data types in a computer program.
- CO5. Design programs involving decision structures, loops and functions.

- *CO6. Explain the difference between call by value and call by reference*
- *CO7. Understand the dynamics of memory by the use of pointers and Structures.*
- *CO8. Use different data structures and create/update basic data files.*

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/PSOs
CO1	PO1,PO2 /PSO1
CO2	PO1,PO2/PSO3
CO3	PO1,PO3/PSO1,PSO3
CO4	PO2,PO3/PSO2
CO5	PO1,PO3/PSO1,PSO2
CO6	PO2/PSO3
CO7	PO1,PO3/
CO8	PO3/PSO1,PSO3

BCAC0002: FUNDAMENTALS OF COMPUTER AND IT

Objective: The objective of this course is that students will be able to learn basic fundamentals and concepts related to computer architecture.

Credits: 04

L-T-P: 4-0-0

Module No.	Content	Teaching Hours
I	<p>Computer Fundamentals: Block Structure of a Computer, Characteristics of Computers, Generation of Computers and Classification of Computers.</p> <p>Programming Languages: Classification, Machine Code, Assembly Language, Higher Level Language and Fourth Generation Languages.</p> <p>Number System: Bit, Byte, Binary, Decimal, Hexadecimal and Octal Systems, Conversion from One System to the Other; Binary Arithmetic Addition, Subtraction and Multiplication.</p> <p>Information Concepts & Processing System: Evolution of Information Processing, Data, Information, Knowledge & Wisdom.</p> <p>Elements of a Computer Processing System: Hardware - Input-Output Devices, VDU, CPU Storage Devices and Media.</p> <p>Software Concepts: Type of Software, Translator, Compiler, Interpreter, Assembler, Loader.</p> <p>Application Software: Office Automation.</p>	26
II	<p>Operating System: Concepts as Resource Manager, Batch Processing, Multiprogramming, Multiprocessing, Time Sharing and Real Time System.</p> <p>DOS: Command Interpreter, Booting Internal & External Commands, Batch Files, exe, com, System Files, bin, txt, bmp Files.</p> <p>Computer Network and Communication: Network Types, Network Topologies; Data Communication – Mode, Channel, and Media; OSI Reference Model, TCP/IP, Data Communication Equipment/Devices.</p> <p>Internet and its Applications: E-Mail, TELNET, FTP, World Wide Web, Internet and Applications.</p>	26

Text Book:

- P.K. Sinha, (2008), “Computer fundamentals”, BPB Publisher, New Delhi, 4th edition.

Reference Books:

- Anita Goel, “Computer fundamentals”, Pearson Education.
- Peter Nortron, “Inside PC”, TMH, New Delhi.
- Alexis Leon, Methews Leon, (1999), “Fundamentals of Information Technology”, Vikas Publishing, New Delhi.

Outcome: After completion of course, student will be able to:

- CO1: Understand the basic concepts of computer hardware and software.
- CO2: Demonstrate problem solving skills.
- CO3: Understand the structure of operating system, its applications and commands.
- CO4: To be familiar with network tools, concepts of protocols and network interfaces.
- CO5: Understands the concept of Computer’s Input/output devices.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/ PSOs
CO1	PO1,PO2 /PSO1
CO2	PO1,PO2/PSO3
CO3	PO1,PO3/PSO1,PSO3
CO4	PO2,PO3/PSO2
CO5	PO1,PO3/PSO1,PSO2

BCAC0003: INTRODUCTION OF LOGICAL CIRCUIT AND DIGITAL DESIGN

Objective: The aim of the subject is to assist the student to understand the fundamentals of digital electronic circuits and to develop the understanding regarding application of elementary ideas of digital electronics in modern technology

Credits: 04

L-T-P: 3-1-0

Module No.	Content	Teaching Hours
I	<p>Introduction to Digital Computer, Digital and analog signal, Block diagram of digital computer.</p> <p>Number systems: Data representation - Binary, Octal, Decimal, Hexadecimal, Conversion from one to another number system. Representation of Positive & Negative numbers; r's and r-1's Complement, Uses of Complement, Arithmetic Operation on Binary Numbers.</p> <p>Binary codes: BCD, ASCII, EBCDIC coding, Gray codes and Excess - 3 codes, alphanumeric representation in ASCII codes. Error-detection codes, even and odd parity.</p> <p>Boolean Algebra Logic gates, Logic expression, Rules and Laws of Boolean algebra, Demorgan's theorems.</p> <p>Minterms, Maxterms, Boolean expression in SOP form and POS form, Conversion of SOP/POS expression to its standard SOP/POS form.</p> <p>Simplifications of Logic equations using laws of Boolean algebra and Karnaugh map.</p> <p>Universal gates, Logic circuit implementation of Boolean expression, Multilevel NAND and NOR implementation.</p>	20
II	<p>Combinational circuits: Adder, Subtractor, Comparator, Decoder, Encoder, Code conversion, Multiplexer, Demultiplexer, Parity bit Checker and Generators; Parallel binary adder/Subtractor, ROM and PLA.</p> <p>Sequential Circuits</p> <p>Flip Flops: Latch, Race around condition, Flip Flops - RS Flip flop using NAND/NOR gates, clocked RS, JK Flip flop, Master slave JK, D Flip flop, T Flip flop, edge triggered flip-flop, conversion of flip-flops,</p> <p>Register: - Definition, shift register with parallel load.</p> <p>Shift Registers: Shift registers function, serial and parallel shift registers, bi-directional shift registers with parallel load.</p> <p>Counters: Asynchronous and synchronous counters, up/down counters, modulo-n counters, BCD counters.</p>	20

Text Book:

- Morris Mano, (2005), "Digital Logic and Computer Design", PHI, New Delhi.

Reference Books:

- R.P.Jain, (2006), "Digital Electronics", Tata McGraw Hill, New Delhi, 3rd edition.
- Anand Kumar, (2009), "Switching Theory", PHI Publication, New Delhi.

Outcome:

- CO1: Acquired knowledge about basics of digital electronics.
- CO2: Acquired knowledge about solving problems related to number systems and Boolean algebra.
- CO3: Ability to identify, analyze and design combinational circuits.

- *CO4: Ability to design various synchronous and asynchronous sequential circuits.*
- *CO5: Acquired knowledge about internal circuitry and logic behind any digital system.*

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/ PSOs
CO1	PO1,PO2 /PSO1
CO2	PO1,PO2/PSO3
CO3	PO1,PO3/PSO1,PSO3
CO4	PO2,PO3/PSO2
CO5	PO1,PO3/PSO1,PSO2

BCAC0004: DATA STRUCTURE USING 'C'

Objective: The objective of this course is that students will have the knowledge to impart the basic concepts of data structures, abstract data type and algorithms, understand the concept of time and space complexity, Understand concepts about searching and sorting techniques and understand basic concepts about array stacks, queues and trees.

Credits: 04

L-T-P: 3-1-0

Module No.	Content	Teaching Hours
I	<p>Introduction: Data, Information, Introduction to Data Structure, Classification Data Structure, Primitive and Composite Data Structure, Time and Space Complexity of Algorithms.</p> <p>Arrays: Definition of an Array, Positional Value of a Member, Base Address of Array, Representation of Array (Single & Multi-Dimensional Arrays), Accessing Array element, String Processing (String Operation, Pattern Matching Algorithm), Address Calculation of Array, Insertion and Deletion on Array, Advantages and Disadvantage of Arrays.</p> <p>Linked List: Pointers, Dynamic Memory Allocation, Singly Linked Lists, and Operations on Linked Lists, Insertion and Deletion of a Node, Introduction to Circularly Linked Lists and Doubly Linked Lists.</p> <p>Stack and Queue: The Concept of List, Introduction to Stack & Primitive Operation on Stack; Stacks Application: Infix, Post Fix, Prefix and Recursion;</p>	20
II	<p>Introduction to Queues: Primitive Operations on the Queues, Circular Queue, Deque, Priority Queue, Applications of Queue.</p> <p>Trees: Basic Terminology, Binary Trees, Tree Representations as Array & Linked List, Basic Operation on Binary Tree, Binary Search Tree(BST), Insertion and Deletion in BST.</p> <p>Traversal of Binary Trees:Inorder, Preorder &Postorder; Application of Binary Tree.</p> <p>Searching Techniques: Linear and Binary Search;</p> <p>Sorting: Internal and External sorting, Bubble, Insertion, Selection.</p>	20

Text Book:

- Lipschutz & Lipson, (2006), "Data Structure using 'C'", Tata McGraw-Hill, New Delhi.

Reference Books:

- Tanenbaum, (2005), "Data Structures Using 'C'", Pearson education, New Delhi, 2ndedition.
- Robert L. Kruse, (2005), "Data Structures and Program Design in 'C'", Pearson education, New Delhi, 2ndedition.
- Esakov and Weises, (2007), "Data Structures: An Advanced Approach Using 'C'", PHI Publication, New Delhi, 3rdedition.
- D. Samantha, (2006), "Classical Data Structure", PHI Publication, New Delhi.
- G. S. Baluja, (2006), "Data Structure Through 'C'", DRP, New Delhi.

Outcome: After completion of course, student will be able to:

- CO1: Understand the concepts of data type and array data structure.
- CO2: Analyze algorithms and determine their time complexity.
- CO3: Understand the concepts of linear data structure such as array, linked list.
- CO4: Implement arrays and linked list data structure to solve various problems.
- CO5: Understand and construct various searching algorithms such as linear search and binary search.
- CO6: Understand and construct various sorting algorithms such as insertion sort, selection sort, and bubble sort.

- *CO7: Understand the concepts of non-linear data structure such as tree.*
- *CO8: Understand the basic concepts of STACK and QUEUE data structure.*

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/ PSOs
CO1	PO1,PO2 /PSO1
CO2	PO1,PO2/PSO3
CO3	PO1,PO3/PSO1,PSO3
CO4	PO2,PO3/PSO2
CO5	PO1,PO3/PSO1,PSO2
CO6	PO2/PSO3
CO7	PO1,PO3/
CO8	PO3/PSO1,PSO3

BCAC0005: FUNDAMENTAL OF DATABASE MANAGEMENT SYSTEM

Objective: The objective of the subject is to assist the student to understand the role of a database management system in an organization along with to Gain a good understanding of the architecture and functioning of database management systems as well as associated tools and techniques, principles of data modeling using entity relationship and develop a good database design and normalization techniques to normalize a database.

Credits: 03

L-T-P: 3-0-0

Module No.	Content	Teaching Hours
I	<p>Basic Concepts: Database & Database users, Characteristics of the Database, DBA, Data models, Schema & Instances, DBMS Architecture & Data Independence, Data Base Languages, Data Modeling using the Entity Relationship Approach. Data Models- Relational, Network, Hierarchical.</p> <p>File Organization Techniques: Sequential file organization, Index File Organization, Random file organization.</p> <p>Relational Model concepts: Relational Data Model Concepts, Relational Algebra,</p>	20
II	<p>Introduction on SQL: Data definition and Data manipulation command in SQL, views and queries in SQL, Specifying Constraints & index in SQL.</p> <p>Normalization: Functional dependencies, normal forms based on primary keys (1NF, 2NF, 3NF & BCNF"), de-normalization, lossless join & dependency preserving decomposition.</p> <p>Transaction: Introduction, Properties (Atomicity, Consistency, Isolation, Durability), Transaction State.</p> <p>Concept of object oriented data base, distributed database and client server database.</p>	20

Text Book:

- Henry F. Korth Abraham silberschatz, (2006), Database system concepts - McGraw - Hill International, New Delhi,5 th.ed.

Reference Books:

- Bipin Desai, (2006), "An Introduction to Database System", West Pub. Co.
- Jeff Parkins and Bryan Morgan, "Teach Yourself SQL in 14 days".
- Elmasri and Navathe (2010), "Fundamentals of Database Systems", 6th edition., Addison Wesley.

Outcome:

- CO1: Understand the basic concepts and the applications of database systems and relational database.
- CO2: Construct an Entity-Relationship (E-R) model from specifications and to transform to relational model.
- CO3: Familiar with basic database storage structures and access techniques: file and page organizations, indexing methods including B tree, and hashing.
- CO4: Construct SQL queries to perform CRUD operations on database. (Create, Retrieve, Update, Delete)
- CO5: Understand the concept of transaction in database.
- CO6: Apply the concepts of normalization and de-normalization to remove database anomalies.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/ PSOs
CO1	PO1/PSO1
CO2	PO1, PO3/PSO1
CO3	PO2/PSO1
CO4	PO2, PO3/PSO1
CO5	PO1/PSO1
CO6	PO1/PSO3

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BCAC0006: FUNDAMENTALS OF OPERATING SYSTEMS

Objective: The objective of this course is that students will be able to know about facilities and services provided by operating system and able to design applications.

Credits: 03

L-T-P: 3-0-0

Module No.	Content	Teaching Hours
I	Basic Elements, Functions and Types of Operating System, Serial Processing, Multi-Programmed, Batch System, Time Sharing Systems, System Components, Operating System Services, Interrupts, Interrupt Processing, Process Management: Concept of Process, Process Control Block, Performance Criteria of Process, Schedulers, CPU Scheduling Algorithm, Shell Layer Architecture of UNIX. Memory Management: Memory Hierarchy, Memory Allocation Scheme, Contiguous allocation, Paging, Page Table Structures, Segmentation, Segmentation with Paging.	20
II	Virtual Memory: Demand Paging, Page Replacement and its Algorithms, Thrashing. I/O Management: I/O Communication Techniques, DMA. Process Synchronization: Critical Section Problem, Two Process Solution, Semaphores, Classical Problem of Synchronization- Bounded Buffer Problem-Producer Consumer Problem And Dining Philosopher Problem. Deadlock: Deadlock Characterizations, Method for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock. File System: Concept, Function of File System, Access Methods, Allocation Methods, Directory System and Protection. Disk Management: Disk Structure, Disk Scheduling Algorithm.	20

Text Book:

- Silberschatz & Galvin, (2006), "Operating System Concepts", Addison Wesley Publication, Singapore, 7th edition.

Reference Books:

- W. Stallings, (2006), "Operating System", Prentice Hall of India. New Delhi, 6th edition.
- Harold Lorin, Harvey M. Deitel, (2005), "Operating systems", Addison Wesley, New Delhi, 2nd edition.
- M. Naghibzadeh, "Operating System", University Press.

Outcome: After completion of course, student will be able to:

- CO1: Understand the concepts related to functions and services of operating system.
- CO2: Describe, contrast and compare different structures of operating system.
- CO3: Understand and analyze theory and implementation of processes, resource control, physical and virtual memory concepts, scheduling, I/O and file management.
- CO4: Acquire a detailed understanding of aspects of different operating systems.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/PSOs
CO1	PO1,PO2,PO7/PSO1
CO2	PO1,PO2 /PSO1
CO3	PO1,PO4/PSO1,POS3
CO4	PO3,PO4,PO6/PSO3,PSO4

BCAC0007: OBJECT ORIENTED PROGRAMMING

Objective: The objective of this course is that the students will be able to develop a greater understanding of the issues involved in programming language design and implementation and having in-depth understanding of functional, logic, and object-oriented programming paradigms.

Credits: 03

L-T-P: 3-0-0

Module No.	Content	Teaching Hours
I	<p>Fundamentals of Object Oriented Programming: Procedure Oriented Programming vs. Object Oriented Programming (OOP).</p> <p>Object Oriented Programming Concepts: Classes, Objects, Encapsulation, Inheritance, Polymorphism, Dynamic Binding, Message Passing and Abstraction; Benefits and Applications of Object Oriented Programming.</p> <p>Introduction to C++: What is C++, A Simple C++ Program, Structure of C++ Program, Dynamic Initialization of Variables, Reference Variables, Scope Resolution Operators, and Manipulators.</p> <p>Functions In C++: Call by Value & Reference, Inline Function, Default Arguments, Function Overloading.</p> <p>Classes And Objects: Creation of Class, Accessing Class Members, Private vs Public Objects, Member Functions, Method Definition, Constant Member Functions, Overloading Member Functions, Array within a Class, Memory Allocation for Objects, Static Data Members and Static Member Functions, Arrays of Objects, Objects as Function Arguments, Friend Functions, and Returning Objects.</p> <p>Constructor and Destructor: Introduction to Constructors Parameterized Constructors, Multiple Constructors in a Class, Constructor with Default Arguments, Copy Constructors.</p> <p>Operator Overloading: Defining Operator Overloading, Overloading Unary Operator, Overloading Binary Operators, Overloading Binary Operators Using Friend, Rules for Overloading Operators.</p>	20
II	<p>Inheritance: Introduction, Defining Derived Classes, Types of Inheritance- Single, Multiple, Multilevel, Hierarchical, Hybrid Inheritance, Virtual Base Classes, Abstract Classes, and Constructors to Derived Classes.</p> <p>Pointers, Virtual Functions: Introduction, Pointers to Objects, Virtual Function Pure Virtual Functions, Object Slicing.</p> <p>Templates Function & Class Templates, Class Templates with Multiple Parameters.</p> <p>Exception Handling: Introduction, Basics of Exception Handling, Exception Handling Mechanism, Throwing Mechanism, Catching Mechanism, Rethrowing an Exception</p>	20

Text Book:

- E. Balaguruswamy, (2006), "Object Oriented Programming in C++", TMH Publishing Co. Ltd., New Delhi, 4th edition.

Reference Books:

- Jense Liberty Tim Keogh, C++, "An Introduction to Programming", BPB Publications, New Delhi
- Robert Lafore, (2006), "OO Programming in C++", Galgotia Publications Pvt. Ltd., Daryaganj, New Delhi.
- Stephen Parata, (1996), "C++ Premier by", TMH Publishing Co. Ltd., New Delhi 1st edition.

Outcome: After completion of course, student will be able to:

- CO1: Understand the difference between the top-down and bottom-up approach
- CO2: Apply the concepts of object-oriented programming

- *CO3: Illustrate the use of predefined and user defined functions*
- *CO4: Apply C++ features to program design and implementation.*
- *CO5: Implements constructors, default constructors, and abstract methods.*
- *CO6: Understand operator overloading concepts and apply to develop programs related to overloading operators*
- *CO7: Understand object-oriented concepts and explain the features and peculiarities of the C++ programming language.*
- *CO8: Apply virtual and pure virtual function concepts in real world problems*

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/PSOs
CO1	PO1,PO3/PSO1,PSO2
CO2	PO1,PO3/PSO1,PSO2
CO3	PO1,PO2/PSO1,PSO2
CO4	PO1 /PSO2,PSO4
CO5	PO1,PO2,PO4/PSO4
CO6	PO1,PO2, PO3/ PSO2
CO7	PO1,PO2,PO11/PSO2
CO8	PO1,PO2,PO3/PSO1,PSO2

BCAC0008: COMPUTER ORGANIZATION AND ARCHITECTURE

Objective: The objective of this course is that the students will be able to conceptualize the basics of organizational and architectural issues of a digital computer and to analyze performance issues in processor and memory design of a digital computer. To understand various data transfer techniques in digital computer.

Credits: 04

L-T-P: 3-1-0

Module No.	Content	Teaching Hours
I	<p>Introduction to Computer Organization and Computer Architecture: Introduction, Von-Neumann and Harvard Architecture; Register Transfer Language, Register Transfer, Bus and Memory Transfer.</p> <p>Micro operations: Arithmetic, Logic Micro Operations and Shift Micro Operations, Macro Operations; Instruction Code, Computer Registers.</p> <p>Computer Instructions: Instruction Types, Memory Reference Instructions, Input-Output, Instruction Cycle, Timing and Control; Interrupts, Types of Interrupt, Interrupt Cycle.</p> <p>Introduction to CPU: General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, RISC vs. CISC, Parallel Processing, Applications,</p>	20
II	<p>Pipelining: Arithmetic Pipeline, Instruction Pipeline, Pipeline Difficulties and Resolution, Vector Processing and its Applications; Flynn's Classification, Control Unit, Micro-Programmed Control, Data Path Design, Bus Organization.</p> <p>Peripheral Devices, Input Output Interface, Asynchronous Data Transfer.</p> <p>Modes of Transfer: Programmed I/O, Interrupt I/O, Direct Memory Access (DMA); Memory Hierarchy;</p> <p>Cache memory: Locality of References, Types of Cache, Characteristics, Mapping of Cache, Cache Coherency Problem.</p>	20

Text Book:

- M. Morris Mano, (2007), "Computer System Architecture", Publication- PHI, New Delhi, 3rdedition.

Reference Books:

- Carl Hamacher, (2002), "Computer Organization", McGraw Hill, New Delhi, 5thedition.
- John P. Hayes, (1998), "Computer Architecture and Organization" McGraw-Hill. New Delhi, 3rdedition.

Outcome: After completion of course, student will be able:

- CO1: To understand basic structure of computer and to perform computer arithmetic operations.
- CO2: To understand control unit operations and to design memory organization that uses banks for different word size operations.
- CO3: To understand the concept of cache mapping techniques and to understand the concept of I/Oorganization.
- CO4: To conceptualize instruction level parallelism.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/PSOs
CO1	PO1,PO3/PSO1
CO2	PO1,PO3/PSO1
CO3	PO2,PO3,PO5/PSO2
CO4	PO2,PO3,PO4/PSO1,PSO3

BCAC0009: INTRODUCTION TO PYTHON

Objective: This course allows basic learning of syntax and semantics and functions in Python programming, construct data structure using OO concepts and its connectivity with database.

Module No.	Content	Teaching Hours
I	<p>Introduction: History, Features</p> <p>Working with Python: Basic Syntax, Variable and Data Types, Operator</p> <p>Conditional Statements: If, If- else, Nested if-else, elif</p> <p>Looping: For, While, Nested loops</p> <p>Control Statements: Break, Continue, Pass</p> <p>Lists: Introduction, Accessing list, Operations, Working with Lists, List</p> <p>Tuple: Introduction, Accessing tuples, Operations Working, Functions and Methods</p> <p>String Manipulation: Accessing Strings, Basic Operations, String slices, Function and Methods</p> <p>Dictionaries: Introduction, Accessing values in dictionaries, working with dictionaries, Properties and Functions</p> <p>Functions and Methods</p> <p>Functions: Defining a function, calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables.</p> <p>Input-Output: Printing on screen, Reading data from keyboard, Opening and closing file, Reading and writing files, Inbuilt-Functions</p>	20
II	<p>Modules: Importing a module, Math module, Random module, Packages, Composition.</p> <p>Exception Handling: Exception, Exception Handling, Except clause, Try & finally clause, User Defined Exceptions</p> <p>OOPs concept: Class and object, Attributes, Inheritance, Overloading, Overriding, Data hiding, Use of self method, _init_ method</p> <p>Regular expressions: Match function, Search function, Matching VS Searching, Modifiers, Patterns</p> <p>Database: Introduction, Connections, Executing queries, Transactions, Handling error</p> <p>Multithreading: Thread, Starting a thread, Threading module, Synchronizing threads, Multithreaded Priority Queue.</p>	20

Text Books:

- Charles Severance, "Python for Informatics", 1st edition., CreateSpace Independent Publishing Platform, 2013.
- Peter Wentworth, Jeffrey Elkner, Allen B. Downey, and Chris Meyers (2012), "How to Think Like a Computer Scientist: Learning with Python", 2nd edition., Open Book Project.

Reference Books:

- Mark Lutz (2013), "Learning Python", 5th edition., O'Reilly Media.
- Wesley Chun (2012), "Core Python Applications Programming", Prentice Hall, 3rd edition..
- Alex Martelli (2006), "Python in a Nutshell", 2nd edition., O'Reilly Media.

Outcome: By the end of the class, students will learn to:

- CO1. Identify the Python's data type - numbers, list, tuple, string, dictionary, class.
- CO2. Recognize Python syntax, semantics, and flow control -if else, for loop, while loop, and

function.

- *CO3. Apply the concepts of file handling and packages.*
- *CO4. Understand the basic concepts - abstraction, encapsulation, inheritance, and polymorphism of object-oriented programming.*
- *CO5. Describe the basic concepts of regular expressions and exception handling.*
- *CO6. Demonstrate database connectivity with applications.*

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

<i>Cos</i>	<i>POs/ PSOs</i>
<i>CO1</i>	<i>P01 /PS01</i>
<i>CO2</i>	<i>P01,P03/PS01</i>
<i>CO3</i>	<i>P05/PS02</i>
<i>CO4</i>	<i>P03/PS01, PS02</i>
<i>CO5</i>	<i>P04,P05/PS02, PS03</i>
<i>CO6</i>	<i>P05/PS01</i>

BCAC0010: SYSTEM DESIGN & SOFTWARE ENGINEERING

Objective: The aim of the subject is to assist the student in understanding the basic theory of software engineering, and to apply these basic theoretical principles to a group software development project.

Credits: 03

L-T-P: 3-0-0

Module No.	Content	Teaching Hours
I	<p>Introduction: System, Components, Characteristics, Types of Systems, SDLC.</p> <p>Introduction to Software Engineering: Software engineering definition, Software characteristics, Software Crisis, Types of Software.</p> <p>Software process: Waterfall, Incremental, Iterative Enhancement, Prototype, RAD and Spiral Models.</p> <p>Software Requirements Engineering: Requirement Engineering: Types of Requirements, Requirement Elicitation Techniques Like Interviews, FAST, QFD, Use case Approach, Requirements Analysis Using DFD, Data Dictionaries & ER Diagrams, Requirements Documentation, and SRS.</p> <p>Software Project Planning: Size Estimation like Lines of Code & Function Count, Cost.</p> <p>Estimation Models: COCOMO (Basic, Intermediate)</p> <p>Software Risk Management: Risk Identification and Risk Analysis</p>	20
II	<p>Software Design: Cohesion & Coupling, Classification of Cohesion & Coupling, Function Oriented Design, Object Oriented Design, Structure chart.</p> <p>Coding: Characteristics of Coding and Coding style.</p> <p>Software Metrics: Software Measurements, Token Count, Halstead Software, Measures.</p> <p>Software Reliability & Quality: Introduction of Mc Call's & Boehm's Quality Model, Capability Maturity Models</p> <p>Software Reliability Models: Basic Execution Time Model.</p> <p>Software Testing: Types of Testing, Functional Testing, Structural Testing, Unit Testing, Integration Testing and System Testing.</p> <p>Software Maintenance: Maintenance Process</p> <p>Maintenance models: Belady and Lehman Model, Boehm Model</p> <p>Regression Testing, Software Configuration Management; Implementation, Introduction to Reengineering and Reverse Engineering.</p>	20

Text Book:

- P Jalote, (2006), "*Integrated Approach to Software Engineering*", Narosa Book Distributors Pvt. Ltd, New Delhi, 3rdedition.

Reference Books:

- K. K. Aggarwal & Yogesh Singh, (2008), "*Software Engineering*", New Age International, 3rdedition.
- R. S. Pressman, (2001), "*Software Engineering – A Practitioner's Approach*", McGraw Hill Int., 5thedition.
- Stephen R. Schach, (1996), "*Classical & Object Oriented Software Engineering*", IRWIN.
- James Peter, W. Pedrycz, "*Software Engineering: An Engineering Approach*", John Wiley & Sons.
- I. Sommerville, (2004), "*Software Engineering*", Addison Wesley, New Delhi, 7thedition.

Outcome: After the completion of the course, the student will be able to:

- CO1: Understand the basic concepts of software engineering.
- CO2: Apply software processes to solve real world problems.
- CO3: Estimate the cost, effort and schedule of software using COCOMO Model.
- CO4: Analyze the software design techniques (structure chart, SDM, sequence diagram).

- C05: Understand the basic concepts of OO analysis and design.
- C06: Develop the test cases to validate the software.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/PSOs
C01	PO1,PO7/PSO1
C02	PO2,PO3/PSO4
C03	PO2,PO11/PSO3
C04	PO3,PO10/PSO4
C05	PO3,PO7/PSO1
C06	PO5,PO12/PSO2

BCAC1011: COMPUTER NETWORKS AND COMMUNICATION

Objective: This course is to provide students with an overview of the concepts and fundamentals of data communication and computer networks.

Credits: 04

L-T-P: 3-1-0

Module No.	Content	Teaching Hours
I	<p>Introductory Concept: Data Communication, Concept, Advantages and Disadvantages of Computer Network, Line Configuration, Topology, Transmission Mode, Categories of Networks; OSI Reference Model and Functions of Layers; Comparison of OSI & TCP/IP, Signals - Analog and Digital, Bandwidth, Periodic and Aperiodic Signals; Transmission Media, Modem, Encoding and Modulation Technique, Multiplexing Techniques, Switching Techniques.</p> <p>Flow Control: Noisy and Noiseless Channel, Transmission Impairment; causes of impairment, attenuation, distortion, noise; types of noises thermal noise, intermodulation noise, cross talk, impulsenoise, Error Detection and Correction Method in Network: VRC, LRC, CRC, Checksum, Hamming Code,</p>	20
II	<p>Access Control: ALOHA, CSMA, CSMA/CD, Framing: Bit Stuffing and Byte Stuffing, Networking and Internetworking Device.</p> <p>Routing Algorithm: Link State and Distance Vector Routing, IP Addressing, Subnetting, Responsibilities of Transport Layer: UDP, TCP, Upper OSI Layers (Session, Presentation And Application).</p>	20

Text Book:

- Behrouz A .Frouzan, (2007), "Data communication and network", TMH, 6thedition.

Reference Books:

- Tanenbaum A. S., (2007), "Computer Networks", edition., Pearson Education, 4thedition.
- Stallings W., (2007), "Data and Computer Communication", TMH 8thedition.

Outcome: After completion of this course the student will be able to:

- CO1: Understand basic computer network technology.
- CO2: Understand and explain Data Communications System and its components.
- CO3: Identify the different types of network topologies and protocols.
- CO4: Enumerate the layers of the OSI model and TCP/IP. Explain the function(s) of each layer.
- CO5: Identify the different types of network devices and their functions within a network.
- CO6: Understand and building the skills of subnetting and routing mechanisms.
- CO7: Familiarity with the basic protocols of computer networks, and how they can be used to assist in network design and implementation.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/PSOs
CO1	PO1,PO3,PO12/PSO1
CO2	PO1/PSO2
CO3	PO1,PO4/PSO1,PSO4
CO4	PO1,PO3/PSO1
CO5	PO1,PO3,PO4,PO6/PSO3
CO6	PO2,PO4/PSO1
CO7	PO5,PO12/PSO2

BCAC0012: PROGRAMMING IN JAVA

Objective: The objective of this course is that the students will understand the foundation of good programming skills by discussing key issues to the design of object-oriented programming.

Credits: 03

L-T-P: 3-0-0

Module No.	Content	Teaching Hours
I	<p>Introduction: Introduction to Java, History of Java, Features of Java, Importance of Java, Byte Code, JVM, JRE, JDK, JIT, Java Implementation, Application of Java, Sample Program & Compilation, Lexical Issues (White Space, Identifiers, Literals, Comments, Separators, Keyword).</p> <p>Data Type, Operators, Control Structures: Variables, Constants, Declaration, Literals, Scope of Variable, Type Casting, Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operator, Dot Operators, Control Statements.</p> <p>Array: Declaration, Creation, Initialization, Length, Two-Dimensional Arrays, Command-Line Arguments.</p> <p>String Handling: Predefined Functions in String, String Methods</p> <p>Introduction of Classes, Objects and Methods: Introduction to Object Class Defining Class, Adding Variables, Adding Methods, Creating Objects, Constructors: Types of Constructors, Keyword this & static, Garbage Collection</p>	20
II	<p>Inheritance: Inheritance, Types of Inheritance, , Creating Multilevel Hierarchy, Method Overloading & Overriding, Dynamic Method Dispatching, final keyword, Abstract Class.</p> <p>Packages And Interfaces: Defining Interfaces. Extending and Implementing Interfaces Defining Packages, Access Protection, Importing Packages,</p> <p>Exception Handling: Exception Types, Multiple Catch Clauses, Nested Try Statements, Throw, Throws, Finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses.</p> <p>Multithreaded Programming: Thread Life Cycle, Creating Threads, Thread Methods, Thread Priority</p> <p>Introduction to Applet Programming- Introduction to Applet ,Applet Architecture ,Applet Life Cycle, Applet Class, Applet Tag, Passing Parameters, Use of Graphics Class, Applet Methods.</p>	20

Text Book:

- Naughton, Schildt, "The Complete Reference JAVA2", 7th edition., TMH.

Reference Books:

- Naughton Patric, Morrision Michel, (2006), "Java Hand Book", Osborne/McGraw-Hill, 5th edition.
- Balaguruswami E., (2007), "Programming with Java", TMH, 3rd edition.
- Decker & Hirshfied, (2000), "Programming Java", Vikas Publication 2nd edition.

Outcome: After completion of course, student will be able to:

- CO1: Understand differences between procedures oriented and object oriented approach.
- CO2: Understand the relevance of Object Oriented Programming techniques.
- CO3: Understand how to write, compile and execute a Java Program.
- CO4: Understand the use of polymorphism and Inheritance.
- CO5: Understand how to define user exceptions and its uses.
- CO6: Understand what is a thread and Multithreading model.
- CO7: Understand how to develop a GUI application.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/PSOs
CO1	PO1,PO3/PSO1,PSO2
CO2	PO1,PO3/PSO1,PSO2
CO3	PO1,PO2/PSO1,PSO2
CO4	PO1 /PSO2,PSO4
CO5	PO1,PO2,PO4/PSO4
CO6	PO1,PO2, PO3/ PSO2
CO7	PO1,PO2,PO11/PSO2

BCAC0013: GUI BASED PROGRAMMING USING VISUAL BASIC

Objective: The objective of this course is to get a simple understanding about procedural and event driven programming language. Emphasis on writing programs using ActiveX controls, loops, event-driven programming, methods, arrays and connecting database so that students can develop windows based applications using Visual Basic.

Credits: 02

L-T-P: 2-0-0

Module No.	Content	Teaching Hours
I	Visual Programming Overview and Environment: Need of Visual Programming, Event Driven Programming, Integrated Development Environment (Menu Bar, Title Bar, Tool Bar, Tool Box and Various Types of Windows). BasicActiveX Controls: Command Button, Text Box, Label Program Elements: Variables, Constant, Operators, Data Types, Conditional Statements. Program Elements and Controls : Loops in VB, Procedures, User Defined Functions, In-Built Functions,	13
II	Array: Static and Dynamic; Picture Box, List Box, Timer Database Controls and Connectivity Dialog Boxes: Inputbox(), MsgBox(), SDI , MDI Menu Editor, Accessing Data Using Data Access Objects, Data Control	13

Text Book:

- Evangelos&Petroustos, (2007), "Mastering Visual Basic 6", BPB Publication, New Delhi, 1stedition.

Reference Books:

- Gary Cornell, (2005), "Visual Basic 6", Tata McGraw Hill, New Delhi, 20thedition.
- Noel Jerke, "Visual Basic 6 (The Complete Reference)", Tata McGraw Hill, New Delhi.
- Eric A. Smith, (2000), "Visual Basic 6 Programming Bible", Wiley India, New Delhi.

Outcome: Upon completion of this course, the student will be able to:

- CO1: Identify the differences between the procedural languages and event-driven languages.
- CO2: Design, create, build, and debug Visual Basic applications.
- CO3: Explore Visual Basic's Integrated Development Environment (IDE).
- CO4: Write Visual Basic programs using object-oriented programming techniques including classes, objects, methods, instance variables, composition and inheritance and polymorphism.
- CO5: Write Windows applications using forms, controls, and events.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/PSOs
CO1	PO,PO2,PO3, PO5, PO9/PSO1
CO2	PO,PO2,PO3, PO5, PO9/PSO1
CO3	PO,PO2,PO3, PO5, PO9/PSO1
CO4	PO,PO2,PO3, PO5, PO9/PSO3
CO5	PO,PO2,PO3, PO5, PO9,PO11,PO12/PSO3

BCAC0014: WEB TECHNOLOGY

Objective: This course is designed to provide a comprehensive study of the evolution of the Internet and the WWW and its underlying web technologies and to understand the design concepts of static and dynamic web pages.

Credits: 04

L-T-P: 4-0-0

Module No.	Content	Teaching Hours
I	<p>Introduction to Web Designing: Web Page, Website, Web Browser, WWW, Internet, e-Mail</p> <p>Overview of HTML: HTML Markup Tags, Linking, Tables and Form.</p> <p>Form Controls: Text Field, Password Field, Multiline Text Area, Drop Down List, Check Box, Radio Buttons, Scrolled List, Reset Button, Submit Button, File Field etc.</p> <p>Overview of DHTML: Introduction, Document Object Model (DOM), Introduction to Cascading Style Sheets (CSS).</p> <p>VB Script: Introduction, Adding Script to Documents, Data types, Operators.</p> <p>Variables: Global & Local Variables, Input and Output Statements, Built in Functions, Arrays.</p>	26
II	<p>Control Statements: if statement, if-then-else, Nested if, Select case Statement.</p> <p>Looping Statements: for...next, do-while, do-until Statements.</p> <p>Events in VB Script</p> <p>JAVA Script: Introduction, Adding Script to Documents, Data Types, Operators, Variables, Input and Output Statements, Built in Functions, Arrays, if Statement, switch Statement.</p> <p>Looping statements: while, do-while, for Statement.</p> <p>Events in JavaScript.</p>	26

Text Book:

- Bates, Chris, (2006), "Web Programming – Building Internet Application", Wiley-Dream tech, 3rdedition.

Reference Books:

- Holzener, Steven, (2001), "Inside XML", Tech-media publication, 1stedition.
- Bergstan, Hans, (2004), "Java Server Page", O'Reilly Publication, 3rdedition.
- Burdman, Jessica, (2000), "Collaborative Web Development", Addison Wesley.
- Stalling, William, (2011), "Cryptography and networks security: Principles and Practice" Prentice Hal, 5thedition.

Outcome: After completion of course, student will be able to:

- CO1: Understand the concepts of www, evolution of www and internet and various client server architecture.
- CO2: Understand the concept of HTML and various tags of html.
- CO3: Understand the concept of adding style in html document.
- CO4: Understand the design of web site using JavaScript.
- CO5: Understand the design of web site using JavaScript.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/PSOs
CO1	PO,PO2,PO3, PO5, PO9/PSO1
CO2	PO,PO2,PO3, PO5, PO9/PSO1
CO3	PO,PO2,PO3, PO5, PO9/PSO1
CO4	PO,PO2,PO3, PO5, PO9/PSO3
CO5	PO,PO2,PO3, PO5, PO9,PO11,PO12/PSO3

BCAC0800: PROGRAMMING LAB

Objective: *The objective of this course is to make students understand the basic concept of C Programming, and its different modules that includes conditional and looping expressions, Arrays, Strings, Functions, Pointers, Structures and File programming.*

Credits: 02

L-T-P: 0-0-4

Module No.	Content	Lab Hours
I/II/III	<p>Introduction to C Programming and Linux Environment</p> <p>Operators, their precedence and associativity</p> <ul style="list-style-type: none"> • Arithmetic Operators on Integers • Arithmetic Operators on Floating point numbers • Relational Operators • Ternary Operators <p>Formatted Input and Output</p> <p>Decision Control</p> <ul style="list-style-type: none"> • if statement ,else statement ,else if ladder ,switch-Case statement <p>Programming based on loops</p> <ul style="list-style-type: none"> • for loop , while loop ,do while loop ,Nested loops <p>Use of special control statement</p> <ul style="list-style-type: none"> • break , continue <p>Programming based on Array</p> <ul style="list-style-type: none"> • One dimensional Array , Two dimensional Array <p>Programming based on function-call by value</p> <ul style="list-style-type: none"> • Call by Value , Recursion <p>Pointers</p> <ul style="list-style-type: none"> • Basics • Problem based on One dimensional array • Problem based on Two dimensional array • Dynamic Memory Allocation • Function call by reference <p>User Defined Data types</p> <ul style="list-style-type: none"> • Structure • Union • Enum <p>File handling</p> <ul style="list-style-type: none"> • Opening a file • Reading, writing and appending a file • Closing file 	48

Text Book:

- Yashavant P. Kanetkar, (2008), "Let us 'C'", BPB Publication, New Delhi, 8th edition.

Reference Books:

- Peter Vander Linden, "Schaum's Outline of theory and problems of programming with C", TMH.
- Peter Vander Linden, "Expert C programming", PHI.
- Balagurusamy, "Computing Fundamentals and C Programming", TMH.

Outcome: *At the end of this course, students will be able to:*

- CO1. Analyze a given problem and develop an algorithm to solve the problem.

- *CO2. Design, develop and test programs written in 'C'.*
 - *CO3. Write, compile and debug programs in C language.*
 - *CO4. Use different data types in a computer program.*
 - *CO5. Design programs involving decision structures, loops and functions.*
 - *CO6. Explain the difference between call by value and call by reference*
 - *CO7. Understand the dynamics of memory by the use of pointers and Structures.CO8. Use different data structures and create/update basic data files.*
- **Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

COs	POs/PSOs
CO1	PO1,PO2 /PSO1
CO2	PO1,PO2/PSO3
CO3	PO1,PO3/PSO1,PSO3
CO4	PO2,PO3/PSO2
CO5	PO1,PO3/PSO1,PSO2
CO6	PO2/PSO3
CO7	PO1,PO3
CO8	PO3/PSO1,PSO3

BCAC0801: INFORMATION TECHNOLOGY LAB

Objective: *The objective of this course would enable the students in crafting professional word documents, excel spread sheets, power point presentations using the Microsoft suite of office tools as well as having basic knowledge of hardware and operating system installation. To familiarize the students in preparation of documents and presentations with office automation tools.*

Credits: 01

L-T-P: 0-0-2

Module No.	Content	Lab Hours
I	<p>How A Computer System Works? Hardware Configuration, Introduction to Basic Components of a Typical PC, Assembling a PC, Installing Operating System, Basic Troubleshooting During the Assembling, Basic Troubleshooting of PC, Introduction to Various Types of Cables and Connectors used in Networking, Introduction to Networking and Networking Concepts, Repeaters, Hubs, Switches, Bridges, Routers, Hubs vs Switches, Installing the NIC Card, MAC Address.</p> <p>Ms Office XP/2007 (A) Ms Word Introduction to Ms Word: Menu Bar, Menus, Submenus, Tool Bar, Tools, Customizing Toolbar, Hiding Toolbar etc., Creating and Saving a Documents, Working with an Existing Document, Auto Text, Auto Complete and Auto Correct. Formatting a Document :Change the Appearance of Text & Paragraph, Copy, Paste and Paste Special Functions, Creating and Modifying a List, Change the Way Each Page Appears in the Document Giving Stress to Line and Page Break Options and Orientation, Changing the Look of Documents with Styles.</p>	12
II	<p>Using Tables and Columns: Table Creation and Modification Giving Stress to Auto-Fit, Auto-Format and Table Sort. Working with Data in Table Giving Stress to Formulas, Presenting Text in Columns, Object Linking and Embedding, Inserting and Sizing Graphics, Hyperlink Envelopes & Label Creation, Grammar & Spell Check, Previewing and Printing Documents.</p> <p>(B) MS Excel Introduction to Electronic Spreadsheet and Microsoft Excel :Creating and Formatting a Worksheet, Features of Excel, Inserting and Formatting Data in a Worksheet, Working with an Existing Data List, Auto Fill, Fill Series and Auto-complete Options, Formatting Cells; Sorting & Filtering Data, Conditional Formatting, Formulas and Functions (Details Usage of Important Data Functions Like Sum, If, Average etc.); Interlinking Worksheets and Files, Setting Filters and Performing Calculations on Filtered Data etc.</p> <p>(C) MS Power Point Introduction to Power Point: Creating A Presentation: Features of Power Point - Editing Master Slides, Viewing and Editing a Presentation, Inserting, Sorting, Hiding and Deleting Slides, Inserting Pictures. Clip Art and Movies in a Slide: Creating and Enhancing a Table, Slide Layouts, Modifying the Slides and Title Master, Adding Transition and Animation Effect, Hyper Linking Slides & Files.</p>	12

Text Book:

- Rajaraman V, (2006), "Computer fundamentals", PHI Publisher, New Delhi, 4thedition.

Reference Books:

- Anita Goel, "Computer fundamentals", Pearson Education
- Peter Nortron, "Inside the PC", TMH, New Delhi

- P.K. Sinha, (2008), “*Computer fundamentals*”, BPB Publisher, New Delhi, 4th edition.

Outcome: After completion of course, student will be able:

- CO1: To understand thoroughly the principles of hardware design in the latest technology.
- CO2: To assemble a PC, installation of OS and NIC card.
- CO3: To perform documentation.
- CO4: To perform presentation skills.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/PSOs
CO1	PO1,PO3/PSO1,PSO2
CO2	PO3,PO4/PSO1
CO3	PO4/PSO2,PSO4
CO4	PO3/PSO2,PSO4

BCAC0802: DATA STRUCTURES USING 'C' LAB

Objective: The objective of this course is that students will have the knowledge to construct and application of various data structures and abstract data types including arrays, stacks, queues and trees.

Credits: 02

L-T-P: 0-0-4

Module No.	Content	Lab Hours
I/II	<p>Array</p> <ul style="list-style-type: none"> ● Introduction ● Operations ● String Operations ● Multidimensional Array ● Operations on multi dimensional array <p>Stack</p> <ul style="list-style-type: none"> ● Push, pop and Traversing ● Infix to prefix <p>Queue</p> <ul style="list-style-type: none"> ● Implementation using array (Insertion and Deletion) ● Circular Queue ● Deque <p>Linked List</p> <ul style="list-style-type: none"> ● Implementation ● Operations on linked list <p>Implementation of Circular Linked List</p> <p>Implementation of Doubly Linked List</p> <p>Searching</p> <ul style="list-style-type: none"> ● Linear Search ● Binary Search <p>Sorting</p> <ul style="list-style-type: none"> ● Insertion Sort ● Bubble Sort ● Selection Sort ● Merge Sort ● Quick Sort ● Radix Sort 	48

Text Book:

- Lipschutz & Lipson, (2006), "Data Structure using 'C'", Tata McGraw-Hill, New Delhi.

Reference Books:

- Tanenbaum, (2005), "Data Structures Using 'C'", Pearson education, New Delhi, 2nd edition.
- Robert L. Kruse, (2005), "Data Structures and Program Design in 'C'", Pearson education, New Delhi, 2nd edition.
- Esakov and Weises, (2007), "Data Structures: An Advanced Approach Using 'C'", PHI Publication, New Delhi, 3rd edition.
- D. Samantha, (2006), "Classical Data Structure", PHI Publication, New Delhi.
- G. S. Baluja, (2006), "Data Structure Through 'C'", DRP, New Delhi.

Outcome: After completion of course, student will be able to:

- CO1: Implement arrays and linked list data structure.
- CO2: Implement various sorting algorithms.
- CO3: Implement linear data structure such as stack, and queue.
- CO4: Implement non-linear data structure tree, using C-programming language.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/PSOs
CO1	PO1,PO2 /PSO1,PSO2
CO2	PO1,PO2/PSO1,PSO3
CO3	PO1,PO3/PSO1
CO4	PO2,PO3/PSO1,PSO3

BCAC0803: DATABASE MANAGEMENT SYSTEM LAB

Objective: To educate students with fundamental concepts of Data Base Design, Data Models, Different Data Base Languages (SQL/Oracle).

Credits: 02

L-T-P: 0-0-4

Module No.	Content	Lab Hours
I/II	<ul style="list-style-type: none"> ● Introduction of Data Definition Language (DDL) and Its commands (Create, Alter, Drop, Rename). ● Introduction of Data Manipulation Language (DML) and Its Commands (Insert, Update, Delete). ● Creation, altering and dropping of tables and inserting rows into a table (use constraints while creating tables) examples using SELECT command. ● Queries to apply different types of constraints in tables. [Not Null, unique, primary key, foreign key, check, default] ● Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING. ● Queries using Conversion functions (to_char, to_number and to_date), ● Queries using String functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr) ● Queries using Date functions (Sysdate, next_day, add_months, last_day, months_between, least, greatest, trunc, round, to_char, to_date) ● To implement concept of Joins in SQL. ● To implement the concept of sub-queries. ● To implement the concept of views 	48

Text Book:

- Henry F. Korth Abraham silberschatz, (2006), "Database system concepts", McGraw - Hill International, New Delhi, 5th ed.

Reference Books:

- Bipin Desai, (2006), "An Introduction to Database System", West Pub. Co.
- Jeff Parkins and Bryan Morgan, "Teach Yourself SQL in 14 days".
- Elmasri and Navathe (2010), "Fundamentals of Database Systems", 6th edition., Addison Wesley.

Outcome: After undergoing this laboratory module, the participant should be able to:

- CO1: Implement SQL queries to a database using SQL DDL commands
- CO2: Design and implement a database schema for a given problem-domain
- CO3: Implement SQL queries to a database using SQL DML commands.
- CO4: Implement integrity constraints on a database using a state-of-the-art RDBMS.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/PSOs
CO1	PO1, PO5/PSO1, PSO2
CO2	PO1, PO3/PSO1
CO3	PO1, PO2/PSO1, PSO2
CO4	PO2, PO3/PSO1, PSO2

BCAC0804: OPERATING SYSTEM LAB

Objective: The course is designed to provide students practical knowledge of various scheduling, page replacement and deadlock handling algorithms.

Credits: 01

L-T-P: 0-0-2

Module No.	Content	Lab Hours
I/II	<p>1. Implement the following basic commands (with options) used in UNIX/LINUX OS:</p> <p>a. ls b. mkdir c. cd d. cat e. man f. date g. cal h. rm i. rmdir j. head k. tail l. pwd</p> <p>2. Implement the following basic commands (with options) used in UNIX/LINUX OS:</p> <p>a. cp b. mv c. sort d. cut e. who f. whoami g. ps h. kill i. bc j. top k. grep l. chmod</p> <p>3. Implement the following basic commands (with options) used in UNIX/LINUX OS:</p> <p>a. nohup b. last c. more d. less e. pg f. history g. touch h. tr i. sed j. emacs k. du l. diff</p> <p>4. Write and implement the basic vi editor commands.</p> <p>5. Shell scripts that uses simple commands:</p> <p>a. Write a shell script to display current date in a particular format, number of users currently login and current month's calendar. b. Write a shell script to display the process name and its pid.</p> <p>6. Decision based Shell scripts:</p> <p>a. Write a shell script that finds whether an entered number is even or odd. b. Write a shell script to input the name of a file as command line argument and display whether it is a file, a directory or anything else. c. Write a shell script to input the marks of a student in 3 subjects and find his grade.</p> <p>7. Shell scripts related to strings:</p> <p>a. Write a shell script to input two strings from the user and determine whether they are same or not. b. Write a shell script to input a string from the user and determine its length. c. Write a shell script to input two strings from the user and find the occurrences of string2 in string 1.</p> <p>8. Shell scripts using pipes:</p> <p>a. Write a shell script to input the name of a file as command line argument and display the number of characters, words and lines in the file. b. Write a shell script to display a list of directories within the current directory and how much space they consume, sorted from the largest to the smallest.</p> <p>9. Shell scripts with loop statements:</p> <p>a. Write a shell script that inputs a number from the user and prints its table on the screen.</p>	24

	<p>b. Write a shell script to implement a timer.</p> <p>10. Implement the basic IPCS commands used in UNIX.</p>	
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Text Book:

- Silberschatz, Galvin and Gagne (2005), “*Operating Systems Concepts*”, 7th edition., Wiley.

Reference Books:

- Kernighan and Ritchie (2011), “*The C Programming Language*”, PHI, 2nd edition..
- P. Dey and M. Ghosh (2000), “*Programming in C*”, Oxford University Press 1st edition..

Outcome: By the end of the class, students will learn to:

- *CO1: Implement CPU scheduling algorithms*
- *CO2: Make algorithm used for deadlock avoidance and prevention.*
- *CO3: Implement page replacement and memory management algorithms.*

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/PSOs
CO1	PO1,PO3,PO4/PSO1
CO2	PO1,PO2/PSO1
CO3	PO1,PO4,PO5/PSO1,PSO2

BCAC0805: OBJECT ORIENTED PROGRAMMING LAB

Objective: As part of this course, students will be able to design efficient computer programs to solve practical engineering problem and write programs for a wide variety problems in math, science, financials, and games.

Credits: 02

L-T-P: 0-0-4

Module No.	Content	Lab Hours
I/II	<p>Basic of C++</p> <ul style="list-style-type: none"> • if statement • if else statement • switch case statement • for loop • while loop • do while loop <p>Functions in C++</p> <ul style="list-style-type: none"> • Function declaration and definition • Function Overloading <p>Introduction of Classes and Objects</p> <ul style="list-style-type: none"> • Program to create class and objects <p>Operator overloading and Friend function</p> <ul style="list-style-type: none"> • Overload Unary operator. • Overload Binary operator. • Friend Function: Program to access the member of one class • Operator Overloading: Unary & Binary operator overloading with friend function <p>Inheritance</p> <ul style="list-style-type: none"> • Simple inheritance • Hierarchical Inheritance • Hybrid Inheritance. <p>Virtual Functions</p> <ul style="list-style-type: none"> • To use the same function name in Inheritance using virtual function <p>I/O in C++</p> <ul style="list-style-type: none"> • Use of various manipulators. • Use of different IOS class Functions For formatting of output. <p>Advanced Features</p> <ul style="list-style-type: none"> • Template function & classes • Try & Catch Function in Exception Handling 	48

Text Book:

- E. Balaguruswamy, (2006), "Object Oriented Programming in C++", TMH Publishing Co. Ltd., New Delhi, 4thedition.

Reference Books:

- Jense Liberty Tim Keogh, C++, "An Introduction to Programming", BPB Publications, New Delhi.
- Robert Lafore, (2006), "OO Programming in C++", Galgotia Publications Pvt. Ltd., Daryaganj, New Delhi.

Outcome: Upon completion of this course, students should be able to:

- CO1: Use C++ to demonstrate practical experience in developing object-oriented solutions.
- CO2: Discover errors in a C++ program and describe how to fix them.
- CO3: Analyze a problem and construct a C++ program that solves it
- CO4: Use primitive data types, selection statements, loops, functions to write programs.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/PSOs
CO1	PO1,PO2/PSO1
CO2	PO3,PO5/PSO2
CO3	PO3,PO5/PSO4
CO4	PO5/PSO4

BCAC0806: PYTHON PROGRAMMING LAB

Objective: The course is designed to provide basic knowledge of Python. Python programming is intended for software engineers, system analysts, program managers and user support personnel who wish to learn the Python programming language.

Credits: 02

L-T-P: 0-0-4

Module No.	Content	Lab Hours
I/II	<p>Programs based on the concepts of:</p> <ul style="list-style-type: none"> ● Basic elements of python (I/O Operations) ● Branching Programs ● Control Structures ● Strings and Input ● Iteration ● System function and their types <p>Usage of Data Structures:</p> <ul style="list-style-type: none"> ● Strings ● Lists ● Tuples ● Dictionary ● Modules <p>Programs related to Handling Exceptions</p> <ul style="list-style-type: none"> ● Try and finally clause ● User defined exceptions <p>Object Oriented Programming:</p> <ul style="list-style-type: none"> ● Classes and Object ● Inheritance ● Encapsulation and Data hiding ● Overloading and Overriding ● Importance of self, __init__() method <p>Regular Expressions, Database Connectivity and Multithreading:</p> <ul style="list-style-type: none"> ● Match functions, search functions and Patterns ● Connection establishment, handling errors ● Synchronizing threads, Multithreaded Priority Queue 	48

Text Book:

- Allen Downey (2015), "Think Python: How to Think Like a Computer", 2nd edition., Green Tea Press.
- Peter Wentworth, Jeffrey Elkner, Allen B. Downey, and Chris Meyers (2012), "How to Think Like a Computer Scientist: Learning with Python", 2nd edition., Open Book Project.

Reference Books:

- John V Guttag "Introduction to Computation and Programming Using Python", Prentice Hall of India.
- R. Nageswara Rao, "Core Python Programming", Dreamtech.
- Wesley J. Chun. "Core Python Programming - Second edition.", Prentice Hall.
- Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, "Data Structures and Algorithms in Python", Wiley.

Outcome: By the end of the class, students will learn to:

- CO1: To develop proficiency in creating based applications using the Python Programming Language.
- CO2: To be able to understand the various data structures available in Python programming language and apply them in solving computational problems.
- CO3: To be able to do testing and debugging of code written in Python.
- CO4: To be able to do text filtering with regular expressions in Python.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/PSOs
CO1	PO2/PSO4
CO2	PO4/PSO1
CO3	PO5/PSO4
CO4	PO5,PO7/PSO1

BCAC0807: PROGRAMMING IN JAVA LAB

Objective: The objective of this course is that the students will understand fundamentals of programming such as variables, conditional and iterative execution, methods, etc. It will also provide the foundation of good programming skills by discussing key issues to the design of object-oriented programming.

Credits: 02

L-T-P: 0-0-4

Module No.	Content	Lab Hours
I/II	<p>Sample java -program execution</p> <p>Programming based on conditional statements by using java</p> <ul style="list-style-type: none"> • if statement • if else statement • switch case statement <p>Programming based on loops by using java</p> <ul style="list-style-type: none"> • for loop • while loop • do while loop <p>Programming based on Operators in java</p> <p>Programming based on Array by using java</p> <p>Programming based on String and String Buffer</p> <p>Programming based Command Line argument</p> <p>Program related to java class and object</p> <p>Programming based on constructor and method in java</p> <ul style="list-style-type: none"> • default • parameterized <p>Programming related to java. lang Package</p> <p>Programming based on polymorphism</p> <ul style="list-style-type: none"> • runtime polymorphism • compile time polymorphism <p>Programming based on keywords by using java</p> <ul style="list-style-type: none"> • static • final • super • this • abstract <p>Programming based on Inheritance</p> <ul style="list-style-type: none"> • single • multilevel • hybrid <p>Programming based on Interface and Package</p> <p>Programming based on Exception handling</p> <p>Programming based on Multithreading</p> <p>Programming based on Applet</p>	48

Text Book:

- Naughton Patrick, SchildHerbertz, (2011), "The Complete Reference -Java", TMH Publication, 7thedition.

Reference Books:

- Naughton Patric, Morrision Michel, (2006), "Java Hand Book", Osborne/McGraw-Hill, 5thedition.
- Balaguruswami E., (2007), "Programming with Java", TMH, 3rdedition.
- Decker &Hirshfied, (2000), "Programming Java", Vikas Publication, 2ndedition.

Outcome: After completion of course, student will be able to:

- CO 1: Implement Java programming concepts and develop programs based on given problem.
- CO 2: Identify the basic elements of object oriented programming and the relationships among them needed for a specific problem
- CO 3: Demonstrate how to achieve reusability using inheritance, interfaces and packages.
- CO 4: Demonstrate the use of multithreading for efficient application development.
- CO 5: Design and implement applet and GUI application programs.
- **Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

COs	POs/PSOs
CO1	PO3/PSO2
CO2	PO3/PSO2
CO3	PO5/PSO2
CO4	PO4/PSO1
CO5	PO5/PSO4

BCAC0808: VISUAL BASIC PROGRAMMING LAB

Objective: The objective of this course is to help the students in finding solutions to various real life problems and converting the solutions into computer program using Visual Basic (Event Driven programming).

Credits: 02

L-T-P: 0-0-4

Module No.	Content	Lab Hours
I/II	<p>Basic of Visual Basic</p> <ul style="list-style-type: none"> • Tool Box, Tool Bar • Project Window, Form Window, Property Window and Code Window • Form Layout Window and Immediate Window • Properties of Label, Text Box, Command Buttons, Option Buttons, Frame and Check Box Controls • Events <p>Programming based on conditional statements</p> <ul style="list-style-type: none"> • If statement , If... Else statement , If...Else Ladder , Switch Case statement <p>Programming based on loops</p> <ul style="list-style-type: none"> • For...Loop , While... Loop, Do...While Loop , While...Wend , Repeat...Until <p>Programming based on ActiveX Controls</p> <ul style="list-style-type: none"> • Label, Text Box, Command Buttons • Option Buttons, Check Box and Frame <p>Programming based on user defined procedure and function</p> <p>Programming based on function-call by value and call by reference</p> <p>Programming based on In-Built functions</p> <ul style="list-style-type: none"> • String , Date <p>Programming based on Array</p> <ul style="list-style-type: none"> • Static array , dynamic array <p>Programming based on Controls</p> <ul style="list-style-type: none"> • Image Control , Picture Box , List Box and Combo Box • Hscroll Bar and Vscroll Bar • Drivet, DirList, FileListbox • Timer and Shape , Line , OLE <p>Programming based on run time errors handling</p> <p>Programming based on Dialog boxes</p> <ul style="list-style-type: none"> • Implementation of MsgBox() , Implementation of Inputbox() <p>Programming based on Menu Editor</p> <p>Programming on Data Control</p> <p>Programming based on Data Access Object(DAO)</p> <ul style="list-style-type: none"> • Implementation of insertion, deletion, updation and searching operations • Implementation of MoveFirst(), MoveLast(), MoveNext() methods <p>Programming based on ADODC</p> <p>Programming based on Grid Control</p>	48

Text Book:

- Evangelos&Petroutsos, (2005), "Mastering Visual Basic 6", BPB Publication, New Delhi, 1stedition.

Reference Books:

- Gary Cornell, (2005), "Visual Basic 6", Tata McGraw Hill, New Delhi, 20thedition.
- Noel Jerke, "Visual Basic 6 (The Complete Reference)", Tata McGraw Hill, New Delhi.

Outcome: Upon successful completion of this course, students will be able to:

- CO1: Design, create, build and debug Visual Basic applications.

- *CO2: Write and apply loop structures, one and two-dimensional arrays for sorting, calculating and displaying of data.*
- *CO3: Know about procedures, sub-procedures, and functions to create manageable code.*
- *CO4: Understand event driven programming and database access.*

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/PSOs
CO1	PO3/PSO2
CO2	PO3/PSO2
CO3	PO5/PSO2
CO4	PO4/PSO1

BCAC0809: WEB TECHNOLOGY LAB

Objective: The objective of this course is that students will have the knowledge to design webpage using basic html – formatting tag, linking and image tags and design web document using table creation, form creation, CSS, VBScript and JavaScript

Credits: 02

L-T-P: 0-0-4

Module No.	Content	Lab Hours
I/II	<p>Basics of HTML</p> <ul style="list-style-type: none"> • HTML head and body • Markup Tags • Linking Tags • Table creation <p>Form Controls</p> <ul style="list-style-type: none"> • Form Creation • Frame Creation • Form Controls- Text Field, Password Field, Multiline Text Area, Drop Down List, Check Box, Radio Buttons, Scrolled List, Reset Button and Submit Button <p>CSS</p> <ul style="list-style-type: none"> • Internal CSS , External CSS <p>Basic of VBScript</p> <ul style="list-style-type: none"> • Adding Script to HTML • VBScript Variable declaration- Global and Local Variable • VBScript Operators • Array Implementation • User defined Functions , Built in Functions <p>Control Statements</p> <ul style="list-style-type: none"> • If statement , If-then-else , Nested if , Select case Statement <p>Looping Statements</p> <ul style="list-style-type: none"> • For...Next , Do...While , Do...Until Statements <p>Events</p> <ul style="list-style-type: none"> • Events handling <p>Basic of JavaScript</p> <ul style="list-style-type: none"> • Adding Script to HTML • VBScript Variable declaration- Global and Local Variable • VBScript Operators • Array Implementation • User defined Functions , Built in Functions <p>Control Statements</p> <ul style="list-style-type: none"> • if statement , Switch Statement <p>Looping Statements</p> <ul style="list-style-type: none"> • For statement , While , Do...while <p>Events</p> <ul style="list-style-type: none"> • Events handling 	48

Text Book:

- Bergstan, Hans, (2004), "Java Server Pages", O'Reilly Publication, 3rdedition.

Reference Books:

- Bates, Chris, (2006), "Web Programming – Building Internet Application", Wiley-Dream tech.
- Holzener, Steven, (2001), "Inside XML", Tech-media publication, 1stedition.
- Burdman, Jessica, (2000), "Collaborative Web Development", Addison Wesley

- Stalling, William, (2011), “*Cryptography and networks security: Principles and Practice*”, Prentice Hal, 5thedition.

Outcome: After completion of course, student will be able to:

- CO1: Design webpage using basic html –formatting tag, linking and image tags.
- CO2: Design web document using table, frame creation and form creation.
- CO3: Design web document using html and adding style using CSS.
- CO4: Design interactive web document using VBScript and JavaScript.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/PSOs
CO1	PO3/PSO1
CO2	PO3/PSO2
CO3	PO1/PSO1
CO4	PO5/PSO4

BCAE0001: ADVANCED DATABASE MANAGEMENT SYSTEM

Objective: The objective of this course is that the students will understand relational and advanced database technology for building applications for the current trend & evaluate a business situation and designing & building database applications.

Credits: 03

L-T-P: 3-0-0

Module No.	Content	Teaching Hours
I	<p>Introduction of RDBMS: Relational Algebra, Relational Calculus, Multi-valued Dependencies and Fourth Normal Form, Join Dependencies and Fifth Normal Form.</p> <p>Query Optimization: General Transformation Rules for Relational Algebra Operations, Heuristic Algebraic Optimization Algorithm, and Cost Optimization for Query Execution.</p> <p>Introduction of Transaction Processing Concepts: Transactions, Properties & States of Transactions, Read and Write Operations, System Log, Commit Point of a Transaction, Desirable Properties of Transactions, Need of Concurrency Control.</p>	20
II	<p>Schedule: Serial, Non-Serial and Conflict Serializable Schedules, Uses of Serializability, View Equivalence and View Serializability.</p> <p>PL/SQL: Function, Procedure, Cursor, Triggers.</p> <p>Concurrency Control Techniques: Two Phase Locking Techniques for Concurrency Control, Concurrency Control Based on Timestamp Ordering.</p> <p>Deadlock: Deadlock Handling, Deadlock Prevention, Deadlock Detection and Deadlock Recovery Techniques.</p> <p>Recovery System: Failure Classification, Storage Structure, Data Access.</p>	20

Text Book:

- Henry F. Korth Abraham Silberschatz, (2006), "Database System Concepts", McGraw-Hill International, New Delhi, 5th.ed.

Reference Books:

- Bipin Desai, (2006), "An Introduction to Database System", West Pub. Co.
- Jeff Parkins and Bryan Morgan, "Teach Yourself SQL in 14 days".

Outcome: After completion of course, student will be able to:

- CO1: Describe the fundamental elements of relational database management systems, relational algebra and relational calculus.
- CO2: Construct the database schema by normalization.
- CO3: Understand the concept of query processing & query optimization.
- CO4: Illustrate basic issues of transaction processing and concurrency control
- CO5: Understand the concept of serial and non-serial schedules.
- CO6: Solve problems using PL/SQL programming concepts by Cursor Management, Procedure, Function and Triggers.
- CO7: Relate the concept of concurrency control and deadlock in databases..
- CO8: Understand the principles of storage structure and recovery management.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/ PSOs
CO1	PO1,PO3 /PSO1, PSO2
CO2	PO1, PO2, PO3 /PSO1, PSO2
CO3	PO1,PO2,PO3 /PSO1, PSO3
CO4	PO1 / PSO3
CO5	PO1,PO3 /PSO3
CO6	PO1,PO3 /PSO1
CO7	PO1,PO2 /PSO2
CO8	PO1,PO2 /PSO2

BCAE0002: ENTERPRISE RESOURCE PLANNING

Objective: The objective of this course is to make students understand the business process of an enterprise, Grasp the activities of ERP project management cycle and understand the emerging trends in ERP developments.

Credits: 04

L-T-P: 4-0-0

Module No.	Content	Teaching Hours
I	ERP: Evolution and Overview of ERP, Features of ERP, Benefits of ERP, Business Modules in ERP Packages for Large and Medium Sized Manufacturing Organizations, Business Process Re-engineering (BPR), Relationship Between ERP & BPR, ERP Vender, ERP Consultants. ERP Implementation I : ERP Implementation Lifecycle, Implementation Methodology, ERP Selection, ERP Implementation Teams	26
II	ERP Implementation II : ERP Implementation Cost, Hidden Cost, Strategies for Successful Implementation, Critical Success and Failure Factors. ERP & Related Technologies, ERP and Internet, ERP and CRM, CRM- Advantages, Benefits, Challenges, ERP and SCM, Integration of ERP, CRM & SCM, Data Warehouse & Data Mining, Case Studies.	26

Text Book:

- Alexis Leon, (2011), "ERP Demystified", Tata McGraw-Hill Publishing Company limited, New Delhi, 2nd edition.

Reference Books:

- Brady, (2005), "Enterprise Resource Planning", Thomson Learning.
- Rahul V. Altekar, (2005), "Enterprise wide Resource Planning", Tata McGraw Hill.
- Vinod Kumar Garg and Venkitakrishnan N K, (2007), "Enterprise Resource Planning –Concepts and Practice", PHI, 2nd edition.
- Imhoff, C. Loftis Lisa & Geiger, G. Jonathan, (2001), "Building the Customer Centric Enterprise", John Wiley & Sons, 1st edition.
- Shankar, Ravi & Jaiswal, S., (1999), "Enterprise Resource Planning", Galgotia Publications, 1st edition.

Outcome: Students may be able to understand the scope of resource planning and implementation.

- CO1: Knowledge of ERP implementation cycle.
- CO2: Awareness of core and extended modules of ERP.
- CO3: Explain about Enterprise Resource Planning, Features of ERP, ERP Architecture, ERP Need Analysis and Return on Investment for ERP
- CO4: Explain ERP Life Cycle, Methodologies and Strategy of ERP and Vendor and Software Selection for ERP.
- CO5: Explain Business Process Re-engineering related to ERP, Implementation Process of ERP, Change Management of ERP, Post Implementation Support, Maintenance and Security required for ERP

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/ PSOs
CO1	PO1,PO3 /PSO1, PSO2
CO2	PO1, PO2, PO3 /PSO1, PSO2
CO3	PO1,PO2,PO3 /PSO1, PSO3
CO4	PO1 / PSO3
CO5	PO1,PO3 /PSO3

BCAE0003: SOFTWARE PROJECT MANAGEMENT

Objective: Define and highlight importance of software project management and to prepare students for undertaking large software projects.

Credits: 04

L-T-P: 4-0-0

Module No.	Content	Teaching Hours
I	<p>Fundamentals of Software Project Management (SPM), Need Identification, Vision and Scope document, Project Management Cycle, SPM Objectives, Management Spectrum, SPM Framework, Software Project Planning, Planning Objectives, Project Plan, Types of project plan.</p> <p>Structure of a Software Project Management Plan, Software project estimation, Estimation methods, Estimation models, Decision process, Project Elements, Work Breakdown Structure (WBS), Types of WBS, Functions, Activities and Tasks.</p> <p>Project Life Cycle and Product Life Cycle, Ways to Organize Personnel, Project schedule, Scheduling Objectives, Building the project schedule, Network Diagrams: PERT, CPM, Bar Charts.</p>	26
II	<p>Dimensions of Project Monitoring & Control, Budgeted Cost for Work Scheduled (BCWS), Cost Performance Index (CPI), Schedule Performance Index (SPI), Types of Review: Inspections, Walkthroughs, Code Reviews</p> <p>Testing Objectives, Testing Principles, Test Plans, Test Cases, Types of Testing, Test Strategies, Testing Automation & Testing Tools, Concept of Software Quality, Software Quality Attributes, Software Quality Metrics and Indicators.</p> <p>Software Configuration Management: Software Configuration Items and tasks, Plan for Change, Change Control, Change Requests Management, Version Control, Risk Management, Risk Breakdown Structure (RBS)</p>	26

Text Book:

- Kelkar, S. A., "Software Project Management", New Delhi: Prentice Hall India Publications.
- Cotterell, M., "Software Project Management", New Delhi: Tata McGraw-Hill Publications.

Reference Books:

- Royce, "Software Project Management", New Delhi: Pearson Education.
- Conway, K., "Software Project Management", New Delhi: Dreamtech Press.

Outcome: After completion of course, student will be able to:

- CO1: Gain brief knowledge of Software Project Management
- CO2: Plan, build and manage project schedules and budgets using Project Professional.
- CO3: Select an excellent appropriate project approach.
- CO4: Evaluate the Project using different methods.
- CO5: Learn Software Project Management strategies.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/PSOs
CO1	PO1/PSO1
CO2	PO1/PSO1,PSO4
CO3	PO2/PSO3
CO4	PO1,PO2/PSO3
CO5	PO1,PO2/PSO1,PSO4

BCAE0004: MANAGEMENT INFORMATION SYSTEM & E-COMMERCE

Objective: *The objective of this course is to provide a basis of understanding to the students with reference to working of business organization through the process of management.*

Credits: 04

L-T-P: 4-0-0

Module No.	Content	Teaching Hours
I	<p>Introduction- Introduction, Meaning and role of MIS, Definition of MIS, and System approach to MIS, MIS Organization, Development of Organizational Theory, Management and Organizational Behavior.</p> <p>Nature of management – Meaning, Definition, it's nature purpose, importance & Functions, Management as Art, Science & Profession- Management as social System Concepts of management-Administration-Organization. , An overview of functions of managers: planning, organizing, staffing, leading and controlling, Coordination: essence of managership, systems approach to management, contingency approach to management.</p> <p>Planning – Meaning, need and importance, Types: missions and purposes, objectives and goals, strategies and policies, levels, advantages and limitations, procedures and rules, Programs and budgets, Steps in planning, Objectives, Management by Objectives, Strategies, policies and planning premises, Strategic planning process, Forecasting: need and techniques, Decision Making: types, process of rational decision making, and techniques of decision making.</p>	26
II	<p>Organizing and staffing- Definition of staffing, Overview of staffing function, Systems approach to human resource management, Recruitment, Selection, Placement, Promotion, Separation, Performance appraisal.</p> <p>Decision making – Types - Process of rational decision making & techniques of decision making Organizing Elements of organizing & processes: Types of organizations, Delegation of authority, Need, difficulties Delegation, Decentralization Staffing: Meaning & Importance, Direction, Nature, Principles Communication: Types & Importance.</p> <p>Strategic Management – Definition, Classes of Decisions, Levels of Decision, Strategy, Role of different Strategist, Relevance of Strategic Management and its Benefits, Strategic Management in India.</p> <p>Recent trends of management- Social Responsibility of Management – environment friendly management, Management of Change, Management of Crisis, Total Quality Management, Stress Management.</p> <p>E-Commerce-Types of e-commerce- B2B, B2C, C2C, and P2P, B2B service provider, e-distributor, Procurement, Importance of E-Commerce, Internet and its role in e-commerce, procedure of registering Internet domain, Tools and Services of Internet.</p>	26

Text Book:

- Koontz, H. and Wehrich, H., “*Essentials of Management*”, Tata McGraw Hill.

Reference Books:

- Horold Koontz and IteinzWeibrich, “*Essential of Management*”, McGrawhills International.
- J.N.Chandan , “*Management Theory & Practice*”.
- K.Aswathapa, “*Essential of Business Administration*”, Himalaya Publishing House.

Outcome:

- *CO1: Understand the critical concepts and terminologies in information systems.*

- *CO2: Understand the role of IT managers in information systems planning, systems development, and hardware and software selection.*
- *CO3: Define problems and the current environment for existing business systems in the areas of accounting, finance, marketing, and manufacturing.*
- *CO4: Know the important business functions provided by typical business software such as Customer Relationship Management (CRM) and Enterprise Resource Planning (ERP).*
- *CO5: Explain the components and roles of the Electronic Commerce environment.*

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/PSOs
CO1	PO1,PO4,PO7,PO8/PSO1
CO2	PO1,PO4,PO7,PO8/PSO1
CO3	PO1,PO7,PO8/PSO1
CO4	PO1,PO7,PO8/PSO1
CO5	PO1,PO7,PO8/PSO3

BCAE0005: DIGITAL MARKETING AND TRANSFORMATION

Objective: *The objective of this course is to provide knowledge about the digital marketing and the industry trends correspondence to the concepts.*

Module No.	Content	Theory Hours
I	<p>Introduction to Digital Marketing Modern Marketing- How Marketing Works, Fundamentals Channels- Awareness, Consideration & Decision Making, Building Integrated Marketing Plan, Lead Journey- From Prospect to Sales.</p> <p>Website and Blogging The Power Of Storytelling, Know Your Customer - Market And Content Research, Construct Prospective Buyer Personas & Journeys, Establishing The Content Ideation & Creation Framework, Creative Design Principles.</p> <p>Content Promotion SEO as an Art and as a Science, Ranking Algorithms, Website Audit, Optimizing Digital Assets & Metadata, Decoding Common Paid Media Platforms, Influencer Marketing, Black Hat, White Hat and Grey Hat SEO.</p> <p>Email Marketing Types of Email (Promo/Trans/NL), ESP Setup & On-boarding, Permission Marketing, Subscriber welcome plan and journey, List segmentation and Management, Personalization and Responsive design, Multivariate Testing, E-commerce Integration, Deliverability and System reputation Management, System Integrations & Automations.</p>	21
II	<p>Social Media Marketing Social Ads Type and their Design Structure, Targeting strategy and planning – Laser/Broad, Effective targeting and custom audience set-up, Campaign setup and reporting on various social platforms.</p> <p>Mobile Marketing Mobile landscapes for Marketing and Monetization, Conventional Advertising, Millennial Mobile Advertising, Versatile Promotions, Alternative focusing and promotions on Mobile, Push App and Game based promotions, Location evolution with mobile</p> <p>Marketing Analytics & ROI Key marketing engagement & ROI metrics, Primer on data science and analytics concepts, Web Traffic nuances, Multi-channel Analytics, Decoding CLV and RFM.</p>	19

Text Book:

- Puneet Singh Bhatia, “*Fundamentals of Digital Marketing*”, First edition., Publication Pearson.

Reference Books:

- Ian Dodson, “*The Art of Digital Marketing: The Definitive Guide to Creating Strategic*”, Targeted and Measurable Online Campaigns, Publication Wiley India Pvt Ltd.
- Philip Kotler, HermawanKartajaya, IwanSetiawan, “*Marketing 4.0: Moving from Traditional to Digital*”, Publication Wiley India Pvt Ltd.
- Vandana Ahuja, “*Digital Marketing*”, 1st edition., Publication Oxford.

- Rohan Yamagishi, “*Digital Marketing in Asia : A Start-Up Guide for Search Engine Marketing in APAC*”, Publication R. R. Bowker.

Outcome: After this course the students should be able to:

- CO1: Learn how to use new media such as mobile, search and social networking.
- CO2: Learn the measurement techniques used in evaluating digital marketing efforts.
- CO3: Understand how and why to use digital marketing for multiple goals within a larger marketing and/or media strategy.
- CO4: Understand the major digital marketing channels - online advertising: Digital display, video, mobile, search engine, and social media.
- CO5: Learn to develop, evaluate, and execute a comprehensive digital marketing strategy and plan
- CO6: Explore the latest digital ad technologies.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/PSOs
CO1	PO1,PO4,PO7,PO8/PSO1
CO2	PO1,PO4,PO7,PO8/PSO1
CO3	PO1,PO7,PO8/PSO1
CO4	PO1,PO7,PO8/PSO1
CO5	PO1,PO7,PO8/PSO3
CO6	PO1,PO4,PO7,PO8/PSO4

BCAE0070: ADVANCED DATABASE MANAGEMENT SYSTEM LAB

Objective: The objective of this course is to provide the great understanding on PL/SQL to proceed with Oracle database and other advanced RDBMS concepts.

Credits: 01

L-T-P: 0-0-2

Module No.	Content	Lab Hours
I/II	<p>Introduction to PL/SQL</p> <ul style="list-style-type: none"> ● PL/SQL - data types, PL/SQL - variables, PL/SQL - operators <p>PL/SQL — Conditions</p> <ul style="list-style-type: none"> ● IF-THEN Statement, IF-THEN-ELSE Statement, CASE Statement <p>PL/SQL — Loops</p> <ul style="list-style-type: none"> ● WHILE LOOP Statement, FOR LOOP Statement, Reverse FOR LOOP Statement <p>PL/SQL — Procedures</p> <ul style="list-style-type: none"> ● Creating a Procedure, Executing a Standalone Procedure, Methods for Passing Parameters <p>PL/SQL — Functions</p> <ul style="list-style-type: none"> ● Creating a Function, Calling a Function <p>PL/SQL — Cursors</p> <ul style="list-style-type: none"> ● Implicit & Explicit Cursors, Declaring the Cursor, Opening & Closing the Cursor <p>PL/SQL — Triggers</p> <ul style="list-style-type: none"> ● Creating Triggers, Triggering a Trigger 	24

Text Book:

- Henry F. Korth Abraham Silberschatz, (2006), "Database system concepts", McGraw - Hill International, New Delhi, 5th edition.

Reference Books:

- Bipin Desai, (2006), "An Introduction to Database System", West Pub. Co.
- Jeff Parkins and Bryan Morgan, "Teach Yourself SQL in 14 days".
- Elmasri and Navathe (2010), "Fundamentals of Database Systems", 6th edition., Addison Wesley.

Outcome: After completion of the course students will have a

CO1: Implement the concepts of PL/SQL conditions, Loops and procedures.

CO2: Implement the concepts of PL/SQL Functions, Cursors, and Triggers.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

Cos	POs/ PSOs
CO1	PO1, PO3 /PSO1
CO2	PO1, PO3 /PSO1

BCAE0071: DIGITAL MARKETING AND TRANSFORMATION LAB

Objective: The course is designed to provide the students with practical knowledge of broad range digital marketing, in addition to an in-depth understanding of how digital marketing is revolutionizing the current industry.

Module No.	Content	Lab Hours
I	<p>Website and Blogging</p> <ul style="list-style-type: none"> ● <u>Basic:</u> <ul style="list-style-type: none"> ○ Creating websites using open source platform ○ Creating Blogs using WordPress ● <u>Advance:</u> <ul style="list-style-type: none"> ○ Creating and managing websites using Adobe Experience Manager* <p>Content Promotion</p> <ul style="list-style-type: none"> ● <u>Basic:</u> <ul style="list-style-type: none"> ○ Indexing & visibility optimization using open source platform ● <u>Advance:</u> <ul style="list-style-type: none"> ○ Optimization mechanism using Adobe Analytics* <p>Email Marketing</p> <ul style="list-style-type: none"> ● <u>Basic:</u> <ul style="list-style-type: none"> ○ Email set up & distribution using open source platform ● <u>Advance:</u> <ul style="list-style-type: none"> ○ Concepts and setup using Salesforce Marketing Cloud/Adobe Campaign Manager* 	12
II	<p>Social Media Marketing</p> <ul style="list-style-type: none"> ● <u>Basic:</u> <ul style="list-style-type: none"> ○ How to be a YouTuber ● <u>Advance:</u> <ul style="list-style-type: none"> ○ Advance Campaign setup on social platform** <p>Mobile Marketing</p> <ul style="list-style-type: none"> ● <u>Advance:</u> <ul style="list-style-type: none"> ○ Managing In-app Push advertising* ○ Advanced flash-add management using Google play store** <p>Marketing Analytics & ROI</p> <ul style="list-style-type: none"> ● <u>Basic:</u> <ul style="list-style-type: none"> ○ Web trafficking using Google Analytics ● <u>Advance:</u> <ul style="list-style-type: none"> ○ Advance analytics using Adobe Analytics* 	12

Text Book:

- Ian Dodson, "The Art of Digital Marketing: The Definitive Guide to Creating Strategic, Targeted and Measurable Online Campaigns", Publication Wiley India Pvt Ltd.

Reference Books:

- Philip Kotler, HermawanKartajaya, IwanSetiawan, "Marketing 4.0 : Moving from Traditional to Digital", Publication Wiley India Pvt Ltd.
- Jeffrey K. Rohrs, "Audience: Marketing in the Age of Subscribers, Fans and Followers", Kindle edition..
- Vandana Ahuja, "Digital Marketing 1st edition.", Publication Oxford.

- Rohan Yamagishi, "Digital Marketing in Asia : A Start-Up Guide for Search Engine Marketing in APAC", Publication R. R. Bowker.

Outcome: By the end of the class, students will learn to:

- CO1: Discuss the key elements of a digital marketing strategy.
- CO2: Illustrate how the effectiveness of a digital marketing campaign can be measured.
- CO3: Demonstrate advanced practical skills in common digital marketing tools such as SEO, SEM, Social media and Blogs.
- CO4: Understand the major digital marketing channels - online advertising: Digital display, video, mobile, search engine, and social media
- CO5: Learn to develop, evaluate, and execute a comprehensive digital marketing strategy and plan
- CO6: Explore the latest digital ad technologies

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/PSOs
CO1	PO1,PO4,PO7,PO8/PSO1
CO2	PO1,PO4,PO7,PO8/PSO1
CO3	PO1,PO7,PO8/PSO1
CO4	PO1,PO7,PO8/PSO1
CO5	PO1,PO7,PO8/PSO3
CO6	PO1,PO4,PO7,PO8/PSO4

BCAE0101: INTRODUCTION TO ARTIFICIAL INTELLIGENCE

Objective: The objective of this course is to study the concepts of Artificial Intelligence and methods of solving problems. It also introduce the concepts of Expert Systems and machine learning.

Credits: 04

L-T-P: 4-0-0

Module No.	Content	Teaching Hours
I	<p>Introduction: Introduction to AI, Task Domains of AI, AI Techniques, Search and Knowledge, Abstraction, Intelligent Agents and its Types.</p> <p>Problem Solving: State Space Search, Production System, Depth First Search, Breadth First Search, Heuristic Search (Hill Climbing, Best First Search and Problem Reduction).</p> <p>Knowledge Representation-I: Approaches, Types and Properties of Knowledge, Propositional Logic, Properties of Statements, Equivalence Law, Inference Laws, First Order Predicate Logic</p>	26
II	<p>Knowledge Representation-II: Properties of Wffs, Representation of Facts in First Order Predicate Logic, Conversion to Clausal Forms, Unification and Resolution, Scripts and Conceptual Dependency.</p> <p>Structural Knowledge Representation: Semantic Network, Partitioned Semantic Net, Semantic Net for Wffs and Predicate Logic, Property Inheritance Algorithm, Frame Structures and Concepts of Regular and Meta Classes With Instance & Isa Relationship.</p> <p>Expert System: Need and Justification of Expert System, Knowledge Acquisition, Inference Engine, Learning Procedure and Case Study of MYCIN.</p>	26

Text Book:

- Rich & Knight, (2010), "Artificial Intelligence", TMH, 3rd edition.

Reference Books:

- DAN W. Patterson, (2006), "Introduction to AI & Expert Systems", PHI.
- Stuart Russell and Peter Norvig, (2011), "Artificial Intelligence-A Modern Approach", PHI, 2nd edition.
- George F. Luger, (2006), "Artificial Intelligence-Structures and Strategies for Complex Problem Solving", Pearson Education / PHI, 4th edition.

Outcome: Upon successful completion of this course, students will be able to:

- CO1: Get overview of Artificial Intelligence.
- CO2: Know various AI search algorithms (uninformed, informed and heuristic algorithms).
- CO3: Understand different types of Artificial Intelligence agents.
- CO4: Understand the fundamentals of knowledge representation (logic-based, frame-based, semantic nets)
- CO5: Know how to build simple knowledge-based systems.
- CO6: Get exposure about Expert system Models.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/PSOs
CO1	PO1,PO2/PSO3,PSO4
CO2	PO2/PSO3
CO3	PO1,PO3/PSO2,PSO3
CO4	PO2/PSO2,PSO3

CO5	PO1 /PSO3
CO6	PO2/PSO3,PSO4

BCAE0102: SOFTWARE TESTING

Objective: The objective of this course is that students will be able to learn basic fundamentals and concepts related to software testing and learn why, when and how to perform various testing.

Module No.	Content	Teaching Hours
I	<p>Review of Software Engineering: Overview of software evolution, SDLC, Testing Process, Terminologies in Testing: Error, Fault, Failure, Verification, Validation, Difference between Verification and Validation, Test Cases, Testing Suite, Test Oracles, Impracticality of Testing All data; Impracticality of testing All Paths.</p> <p>Verification: Verification methods, SRS verification, Source code reviews, User documentation verification, Software project audit, Tailoring Software Quality Assurance Program by Reviews, Walkthrough, Inspection, and Configuration Audits.</p> <p>Functional Testing: Boundary Value Analysis, Equivalence Class Testing, Decision Table Based Testing, Cause Effect Graphing Technique.</p> <p>Structural Testing: Control flow testing, Path testing, Independent paths, Generation of graph from program, Identification of independent paths, Cyclomatic Complexity, Data Flow Testing, Mutation Testing.</p>	28
II	<p>Regression Testing: What is Regression Testing? Regression Test cases selection, Reducing the number of test cases, Code coverage prioritization technique.</p> <p>Software Testing Activities: Levels of Testing, Debugging, Testing Techniques and their applicability, Exploratory Testing.</p> <p>Automated Test Data Generation: Test Data, Approaches to test data generation, test data generation using genetic algorithm, Test Data Generation Tools, Software Testing Tools, and Software test Plan.</p>	24

Text Book:

- Yogesh Singh(2012), "*Software Testing*", Cambridge University Press, New York, 3rd edition..

Reference Books:

- Roger S. Pressman(2001), "*Software Engineering – A Practitioner’s Approach*", Fifth edition., McGraw-Hill International edition., New Delhi.
- Marc Roper(2012), "*Software Testing*", McGraw-Hill Book Co., London, 5thedition..
- Alexis Leon, Methews Leon, (1999), "*Fundamentals of Information Technology*", Vikas Publishing, New Delhi.

Outcome: After completion of course, student will be able to:

- CO1: Understand the basic concepts of software testing and tools.
- CO2: Demonstrate problem solving skills.
- CO3: Analyze requirements to determine appropriate testing strategies.
- CO4: Design various test cases for quality improvement.
- CO5: Understand different levels of software testing.
- CO6: understand concept of system testing.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/PSOs
CO1	PO1,PO11/PSO1
CO2	PO3,PO5/PSO1,PSO2
CO3	PO1,PO2/PSO1,PSO3
CO4	PO1,PO2/PSO1,PSO3
CO5	PO1,PO2/PSO2,PSO3
CO6	PO1,PO2,PO4/PSO1,PSO3

BCAE0103: CYBER SECURITY

Objective: *The course objective is to explain students the core information assurance (IA) principles and introduces the key components of cyber security network architecture, security tools and hardening techniques.*

Module No.	Content	Teaching Hours
I	<p>Introduction to Cyber Crime and law A Brief History of the Internet, Recognizing and Defining Computer Crime, Types of Cybercrime, Hacking, Attack vectors, Cyberspace and Criminal Behavior, Clarification of Terms, Traditional Problems Associated with Computer Crime, Introduction to Incident Response, Digital Forensics, Computer Language, Network Language, Realms of the Cyber world, , Contemporary Crimes, Computers as Targets, Contaminants and Destruction of Data, Indian IT ACT 2000.</p> <p>Introduction to Cyber Crime Investigation Firewalls and Packet Filters, password Cracking, Keyloggers and Spyware, Virus and Worms, Trojan and backdoors, Steganography, DOS and DDOS attack, SQL injection, Buffer Overflow, Attack on wireless Networks</p> <p>Network Defense tools -I Firewalls and Packet Filters: Firewall Basics, Packet Filter Vs Firewall, How a Firewall Protects a Network, Packet Characteristic to Filter, Stateless Vs Stateful Firewalls,</p>	18
II	<p>Network Defense tools -II Network Address Translation (NAT) and Port Forwarding, the basic of Virtual Private Networks, Linux Firewall, Windows Firewall, Snort: Introduction Detection System</p> <p>Web Application Tools Scanning for web vulnerabilities tools: Nikto, W3af, HTTP utilities - Curl, OpenSSL and Stunnel, Application Inspection tools – Zed Attack Proxy, Sqlmap. DVWA, Webgoat, Password Cracking and Brute-Force Tools – John the Ripper, L0htcrack, Pwdump, HTC-Hydra</p>	17

Text Books:

- Nina Godbole and SunitBelpure, “*Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives*”, Publication Wiley.

Reference Books:

- Mike Shema, “*Anti-Hacker Tool Kit*”, Indian edition., Publication McGraw Hill.

Outcome: *After learning the course the students should be able to:*

- CO1: Understand the basics of cyber security.
- CO2: Explain the basic concepts of System security.
- CO3: Understand the different investigation mechanism of cyber security.
- CO4: Explain the digital forensics in system security.
- CO5: Illustrate the laws and acts in cyber domain.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/PSOs
CO1	PO1,PO2,PO3,PO6,PO12/PSO1,PSO3
CO2	PO1,PO2,PO3,PO4,PO5/PSO1,PSO4
CO3	PO1,PO3,PO4,PO6/PSO1,PSO3,PSO4
CO4	PO1,PO2,PO5/PSO1,PSO3
CO5	PO1, PO3,PO5/PSO1,PSO3

BCAE0104: DATA MINING AND WAREHOUSING

Objective: To understand various tools of Data Mining and their techniques to solve the real time problems.

Module No.	Content	Teaching Hours
I	<p>Data Warehousing: Overview, Definition, Data Warehousing Components, Building a Data Warehouse, Warehouse Database, Mapping the Data Warehouse to a Multiprocessor Architecture, Difference between Database System and Data Warehouse.</p> <p>Data Model: Concept Hierarchy, Three-Tier Architecture, Meta Repository, Data Warehouse & OLAP Technology, Types of OLAP Servers.</p> <p>Multi Dimensional Data Model: Data Cubes, Stars, Snow Flakes, Fact Constellations, Concept hierarchy, Process Architecture, Data Marting.</p> <p>Data Warehouse Process and Technology: Warehousing Strategy, Warehouse/management and Support Processes, Warehouse Planning and Implementation, Hardware and Operating Systems for Data Warehousing, Client/Server Computing Model & Data Warehousing. Parallel Processors & Cluster Systems, Distributed DBMS implementations.</p>	28
II	<p>Mining frequent Patterns: Basic Concepts of Association Rules Mining, Apriori Algorithm, FP-Growth. Multilevel Association Rules, Multi Dimensional Association Rules.</p> <p>Data Mining Cluster Analysis: Data Types in Cluster Analysis, Categories of Clustering Methods, Partitioning Methods. Hierarchical Clustering. CURE and Chameleon. Density Based Methods -DBSCAN, OPTICS. Grid Based Methods -STING, CLIQUE.</p> <p>OLAP Servers: ROLAP, MOLAP, HOLAP, Data Mining interface, Security, Backup and Recovery, Tuning Data Warehouse, Testing Data Warehouse. Warehousing applications</p>	24

Text Book:

- Jiawei Han, Micheline Kamber(2011), "*Data Mining Concepts & Techniques*", 3rd edition., Morgan Kauffmann

Reference Books:

- M.H.Dunham(2003), "*Data Mining: Introductory and Advanced Topics*", 1st edition., Pearson Education.
- Sam Anahory, Dennis Murray(2009), "*Data Warehousing in the Real World: A Practical Guide for Building Decision Support Systems*", 4th edition., Pearson Education.

Outcome: After completion of course, student will be able to

- CO1: Understand and apply the concept of data warehouse and mining in real-life applications.
- CO2: Apply the principle algorithms used in modern machine learning.
- CO3: Apply the information theory and probability theory to get the basic theoretical results in Data Mining.
- CO4: Apply Data mining algorithms to real datasets, evaluate their performance and appreciate the practical issues involved.
- CO5: Implement clustering using various clustering methods on data set.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/PSOs
CO1	PO1,PO2/PSO1
CO2	PO1,PO3,PO4/PSO1,PSO3
CO3	PO1 /PSO1
CO4	PO1 /PSO2
CO5	PO3/PSO2

BCAE0105: DISCRETE STRUCTURE & GRAPH THEORY

Objective: The objective of this course is that students will be able to explain and apply the basic methods of discrete (non continuous) mathematics, these methods are used in subsequent courses in the design and analysis of algorithms, computability theory, software engineering, and computer systems.

Credits: 04

L-T-P: 3-1-0

Module No.	Content	Teaching Hours
I	<p>Propositions –Logical connectives , Compound propositions , Conditional and biconditional propositions, Truth tables , Tautologies and contradictions, DeMorgan’s Laws , Rules of inference, Validity of arguments.</p> <p>Predicates –Quantifiers, Universe of discourse, Logical equivalences and implications for quantified statements, Theory of inference, the rules of Universal specification and generalization Validity of arguments.</p> <p>Sets –Introduction and algebra of sets, Venn diagram, Principle of inclusion and Exclusion.</p>	20
II	<p>Relation- Introduction, types and properties. Introduction to Recurrence Relation, Linear recurrence relations with constant coefficients, Homogeneous solutions, Particular solutions, Total solutions, Generating functions, Solution of recurrence relation by the method of generating functions</p> <p>Graphs –Introduction, Sub graphs, Isomorphism, Walks, Paths, Circuits Connectedness, Components, Euler Graphs, Hamiltonian Paths and Circuits</p> <p>Trees –Properties of trees, Distance, Centers, radius and eccentricity in Tree, Rooted and Binary Trees. Incidence matrix Circuit Matrix, Path Matrix, Adjacency Matrix. Spanning tree –Finding all Spanning Trees of a Graph, Set of Fundamental Circuits, Cut Vertices, Dijkstra’s Algorithm, Prim’s Algorithm, Kruskal’s Algorithm</p>	20

Text Book:

- Satendra Bal Gupta, (2008), “Discrete Mathematics”, 5th edition., Laxmi publication. New delhi.

Reference Books:

- D.K. Gupta, “Discrete Mathematics”, KNRN Publishing, Delhi.
- Narsingh Deo, “Graph Theory”, PHI, New Delhi.
- Adesh K. Pandey, S.K. Kataria, (2007), “Discrete Structure”, Sons Publishing, New Delhi.

Outcome: After completion of course, student will be able to:

- CO1: Use logical notation to define and reason about fundamental mathematical.
- CO2: Concepts such as sets, relations, functions, and integers.
- CO3: Synthesize induction hypotheses and simple induction proofs.
- CO4: Apply graph theory models of data structures and state machines to solve problems of Connectivity and constraint satisfaction, for example, scheduling.
- CO5: Calculate numbers of possible outcomes of elementary combinatorial processes such as permutations and combinations.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/PSOs
CO1	PO1,PO2/PSO1,PSO3
CO2	PO1,PO3/PSO4
CO3	PO2,PO3/PSO3
CO4	PO2,PO3/PSO3
CO5	PO1,PO2/ PSO3

BCAE0106: DESIGN & ANALYSIS OF ALGORITHMS

Objective: The objective of this course is to study paradigms and approaches used to analyze and design algorithms and to appreciate the impact of algorithm design in practice. It also ensures that students understand how the worst-case time complexity of an algorithm is defined, how asymptotic notation is used to provide a rough classification of algorithms, how a number of algorithms for fundamental problems in computer science and engineering work and compare with one another, and how there are still some problems for which it is unknown whether there exist efficient algorithms, and how to design efficient algorithms.

Credits: 04

L-T-P: 3-1-0

Module No.	Content	Teaching Hours
I	<p>Basic of Algorithm Analysis: Analyzing Algorithms, Worst Case and Average Case Analysis, Asymptotic Notations (Omega, Theta, Big "Oh", Little "Oh", Little Omega).</p> <p>Recurrences: Substitution Method, Recursion Tree Method, Master Method.</p> <p>Divide and Conquer Method: Binary Search, Merge Sort and Quick Sort.</p> <p>Sorting in Linear Time: Radix Sort and Insertion Sort.</p> <p>Graph Algorithms: Elementary Graph Algorithms, Breadth First Search, Depth First Search.</p> <p>Minimum Spanning Tree: Kruskal's Algorithm, Prim's Algorithm,</p>	20
II	<p>Single Source Shortest Path: Dijkstra's Algorithm.</p> <p>All Pair Shortest Path: Floyd-Warshall Algorithm, Traveling Salesman Problem.</p> <p>Advanced Data Structures: B-Trees.</p> <p>Dynamic Programming: Elements of Dynamic Programming, Matrix Chain Multiplication, Longest Common Subsequence.</p> <p>Greedy Method: Knapsack Problem, Huffman Coding.</p> <p>Advanced Data Structures: AVL Tree, 2-3 Tree, 2-3-4 Tree</p>	20

Text Book:

- Thomas H. Cormen, Charles E. Leiserson and Ronald L. Rivest, (2010), "Introduction to Algorithms", Printice Hall of India, 5thedition..

Reference Books:

- RCT Lee, SS Tseng, RC Chang and YT Tsai, (2006), "Introduction to the Design and Analysis of Algorithms", McGraw Hill.
- E. Horowitz & S. Sahni, (2007), "Fundamentals of Computer Algorithms", Galgotia Publication Pvt. Ltd.
- Aho, Hopcraft, Ullman, (2008), "The Design and Analysis of Computer Algorithms", Pearson Education.
- D. E. Knuth, (1998), "The Art of Computer Programming", Addison Wesley, 3rdedition..

Outcome :

- CO1. Analyze worst-case running times of algorithms using asymptotic analysis.
- CO2. Apply the sorting algorithms (Insertion, Merge, Quick and Radix Sort) to solve real life applications.
- CO3. Apply the divide-and-conquer paradigm (Binary Search) and explain when an algorithmic design situation calls for it.
- CO4. Analyze the major graph algorithms (Depth First Search and Breath First Search).
- CO5. Understand the single source and all pair shortest path problems. Solve it using existing algorithms

and analyze its time complexity.

- C06. Understand the dynamic-programming paradigm to solve Matrix Chain Multiplication and Longest Common Subsequence problems.
- C07. Illustrate the greedy paradigm (Knapsack Problem and Huffman Coding) and explain when an algorithmic design situation calls for it.
- C08. Compare the difference between different data structures. Pick an appropriate data structure for a design situation.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/ PSOs
CO1	PO1,PO2 / PSO3
CO2	PO2/PSO1
CO3	PO3/PSO1,POS2
CO4	PO1,PO4/POS1,PSO3
CO5	PO3/PSO2
CO6	PO2,PO3/PSO3
CO7	PO2,PO5/PSO2
CO8	PO1,PO5/PSO1,PSO3

BCAE1201: PROGRAMMING IN ADVANCED JAVA

Objective: The objective of this course is to cover the basics of creating APIs as well as allow students to explore the Java Abstract Programming Interface (API) and Java Collection Framework through programming assignments.

Credits: 03

L-T-P: 3-0-0

Module No.	Content	Teaching Hours
I	<p>Collection Framework: List Interface, Set Interface, Sorted Set Interface. Array List Class, Linked List Class, Hash Set Class, Linked Hash Set Class, Accessing a Collection via Iterator</p> <p>I/O Files in Java: Stream: Byte Stream Classes, Character Stream Classes, File IO basics, File operations Creating file Reading file, Writing file.</p> <p>GUI Programming: Introduction to AWT Programming, Basic GUI Components (Labels, Buttons, Checkboxes, Checkbox Group, Choices, Text Fields, Text Areas, Lists, Scrollbars, Panels, Windows, Menus, Menu bars), Layout Managers.</p> <p>Graphical User Interface: Event Driven Programming in Java, Event Handling Process, Event Handling Mechanism, The Delegation Model of Event Handling, Event Classes, Event Sources, Event Listeners</p>	20
II	<p>Swing: Swing Architecture, Introduction to Swing Component, Comparison of Swing Component and AWT Component, Creating a Swing Applet and Application. Swing's Architecture & background, Container and Frame, Basic Swing Programming: Swing lists, Swing tables, Swing tree.</p> <p>JDBC Connectivity: Types of Drivers, The Connectivity Model, JDBC/ODBC Bridge Communicating with Database</p> <p>Introduction to Servlets: Need for Servlets, Introduction to Servlets, The javax, Servlet Package, Life Cycle of a Servlet, Http Servlet Request, Http Servlet Response, Deploying Servlets and Servlet Contexts, Accessing a Servlet Using an HTML Page.</p> <p>Introduction to JSP: Need for JSP, The JSP Request Response Class; Connectivity JSP Pages to Data Base.</p>	20

Text Book:

- Naughton Patrick, SchildHerbertz, (2011), "The Complete Reference -Java", TMH Publication, 7th edition..

Reference Books:

- Naughton Patric, Morrision Michel, (2006), "Java Hand Book", Osborne/McGraw-Hill, 5th edition..
- Balaguruswami E, (2001), "Programming with Java", TMH, 3rd edition..
- Decker & Hirshfied, (2000), "Programming Java", Vikas Publication 2nd edition..

Outcome: After completion of course, student will be able to:

- CO1: Understand the key concepts of object oriented programming and have an ability to design OO programs and appreciate the techniques of good design;
- CO2: Understand advanced features of Java
- CO3: Analyze complex programming problems and optimize the Solutions

- *CO4: Apply an understanding of problems and their solutions using JAVA*

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/PSOs
CO1	PO1,PO3,PO5,PO7/PSO2
CO2	PO1,PO3,PO7/PSO1
CO3	PO1,PO7/PSO1
CO4	PO1,PO3,PO5/PSO4

BCAE0202: INTRODUCTION TO DISTRIBUTED SYSTEM

Module No.	Content	Teaching Hours
I	<p>Introduction to Distributed System: Introduction to Distributed Systems and Design Issues, Distributed System Characteristics,</p> <p>Systems Models: Architectural Model, Fundamental Model, Examples of Distributed System,</p> <p>Clock Concept in Distributed System: Limitation of Distributed System, Lamport Clock & Vector Clock, Causal Ordering of Events</p> <p>Distributed Mutual Exclusion: Classification & Requirements for mutual exclusion, Performance Matrices for Measurement, Non-Token based algorithms- Lamport Algorithm, Ricart-Agrawala Algorithm, Token Based Algorithm-Suzuki-Kasmi Algorithm</p> <p>Distributed Deadlock: Distributed Deadlock Handling Strategies and Issues, Centralized Deadlock Detection-Ho Ramamurthy Algo, Distributed Deadlock Detection- Path Pushing Algo:-Obermarek et al. Algo Edge chasing Algorithm: - Chandy Mishra Haas algo.</p>	26
II	<p>Agreement Problem: Classification of Agreement Protocols, Byzantine Agreement Problem, Solution to Byzantine Agreement Problem:- lamport, pease et al. Algo.</p> <p>Communication in Distributed System: RMI, RPC</p> <p>Distributed File System: Introduction to distributed file system,</p> <p>Failure Recovery: Failure Recovery-Backward & Forward Recovery, Recovery in Concurrent Systems-Synchronous Algo:- The Checkpoint Algo., Asynchronous Algorithm for Check pointing and recovery</p> <p>Distributed Shared Memory: Design issues in Distributed Shared Memory, Algorithm for Implementation of DSM</p>	26

Objective: *To understand the fundamental knowledge in distributed computing.*

Credits: 04

I T B A O

Text Book:

- B. Coulouris, Dollimore, Kindberg, "*Distributed System: Concepts and Design*", Pearson edition..

Reference Books:

- A. Singhal & Shivaratri, "*Advanced Concept in Operating Systems*", McGraw Hill.
- C. Tannenbaum (2004) "*Distributed Systems: Principles and Paradigms*", Pearson Education.

Outcome:

- CO1: Understand the concepts and issues related to distributed systems.
- CO2: Design and develop the programs for distributed environment.
- CO3: Manage performance, reliability and other issues while designing in distributed environment.
- CO4: List the principles of distributed systems and describe the problems and challenges associated with these principles.
- CO5: Understand Distributed Computing techniques, Synchronous and Processes.
- CO6: Apply Shared Data access and Files concepts.
- CO7: Design a distributed system that fulfills requirements with regards to key distributed systems properties.
- CO8: Understand Distributed File Systems and Distributed Shared Memory.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/PSOs
CO1	PO1/PSO1
CO2	PO1,PO2/PSO1
CO3	PO1,PO2,PO3/PSO1,PSO2
CO4	PO1,PO2/PSO1,PSO2
CO5	PO1,PO2/PSO1
CO6	PO1,PO2,PO4/PSO1
CO7	PO3/PSO2
CO8	PO4/PSO2

BCAE0203: INTRODUCTION TO CLOUD COMPUTING

Objective: *The objective of this course is to enhance cloud computing environment, to study various platforms & to study the applications that uses cloud computing.*

Credits: 04

L-T-P: 4-0-0

Module No.	Content	Teaching Hours
I	<p>Overview of Computing Paradigm – Recent trends in Computing Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing Evolution of cloud computing, Business driver for adopting cloud computing.</p> <p>Introduction to Cloud Computing – (NIST Model) Introduction to Cloud Computing, History of Cloud Computing, Cloud service providers Properties, Characteristics & Disadvantages Pros and Cons of Cloud Computing, Benefits of Cloud Computing, Cloud computing vs. Cluster computing vs. Grid computing Role of Open Standards.</p> <p>Cloud Computing Architecture – Cloud computing stack Comparison with traditional computing architecture (client/server), Services provided at various levels, How Cloud Computing Works, Role of Networks in Cloud computing, protocols used</p>	18
II	<p>Role of Web services Service Models (XaaS) Infrastructure as a Service(IaaS) , Platform as a Service(PaaS), Software as a Service(SaaS) Deployment Models Public cloud, Private cloud, Hybrid cloud, Community cloud</p> <p>Infrastructure as a Service (IaaS) – Introduction to IaaS, Introduction to virtualization, Different approaches to virtualization, Hypervisors, Machine Image, Virtual Machine (VM) Resource Virtualization Server.</p> <p>Cloud Security – Infrastructure Security Network level security, Host level security, Application level security Data security and Storage Data privacy and security Issues</p>	17

Text Book:

- Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, (2011), “*Cloud Computing: Principles and Paradigms*”, Wiley.

Reference Books:

- Nikos Antonopoulos, Lee Gillam, (2012), “*Cloud Computing-Principles, Systems and Applications*”, Springer.
- Ronald L. Krutz, Russell Dean Vines, (2010), “*Cloud Security- A Comprehensive Guide to Secure Cloud Computing*”, Wiley-India.
- Anthony T. Velte(2009), “*Cloud Computing: A Practical Approach*”, Tata McGraw Hill.

Outcome: *After completion of course, student will be able to:*

- CO1: *To understand the basic concept of cloud computing environments.*
- CO2: *Gain Knowledge of cloud building blocks and technologies.*
- CO3: *To understand cloud computing security issues and virtualization techniques.*
- CO4: *Identify the known threats, risks, vulnerabilities and privacy issues associated with Cloud based IT services*
- CO5: *Apply fundamental concepts in cloud infrastructures to understand the tradeoffs in power, efficiency and cost*
- CO6: *Identify the Challenges in managing heterogeneous clouds.*

-
- **Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

COs	POs/PSOs
CO1	PO5/PSO5
CO2	PO3/PSO4
CO3	PO3,PO5/PSO4
CO4	PO3,PO5/PSO4
CO5	PO3/PSO2
CO6	PO2/PSO4

BCAE0204: INTRODUCTION TO BIG DATA

Objective: This course will cover the basic concepts of big data, methodologies for analyzing structured and unstructured data with emphasis on the relationship between the Data Scientist and the business needs.

Credits: 03

L-T-P: 3-0-0

Module No.	Content	Teaching Hours
I	<p>Introduction to Big Data – Big Data and its Importance, Challenges of Conventional Systems, Four V’s of Big Data, Drivers for Big Data, Introduction to Big Data Analytics, Big Data Analytics applications, Intelligent data analysis Nature of Data - Analytic Processes and Tools - Analysis vs Reporting.</p> <p>Introduction To Streams Concepts – Stream Data Model and Architecture, Stream Computing, Sampling Data in a Stream, Filtering Streams, Counting Distinct Elements in a Stream.</p> <p>Big Data Technologies-I - History of Hadoop, The Hadoop Distributed File System, Components of Hadoop,</p>	20
II	<p>Big Data Technologies-II - Analyzing the Data with Hadoop, Scaling Out-Hadoop Streaming, HDFS basics, Developing a Map Reduce Application, How Map Reduce Works.</p> <p>Big Data Tools and Techniques - Applications on Big Data Using Pig, Comparison with Databases, Pig Latin, User-Defined Functions, Data Processing Operators in Pig.</p> <p>Introduction of Hive - HiveQL, Querying Data in Hive, User-Defined Functions.</p>	20

Text Book:

- Jason Kolb, Jeremy Kolb, (2013), “The Big Data Revolution”.

Reference Books:

- WAGmob, (2013), “Big Data and Hadoop”, 1.5 edition..

Outcome: After completion of the course, the student will be:

- CO 1: Understand the concepts and challenges of big data.
- CO 2: Apply existing technology to collect, manage, store, query, and analyze the big data.
- CO 3: Apply job scheduling of various applications and resource management using Hadoop and Yarn.
- CO 4: Apply the data summarization, query, and analysis of big data using pig and hive.
- CO 5: Design the regression model, cluster and decision tree of big data.
- CO 6: Experiment with hands-on experience in large-scale analytics tools to solve big data problems.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/PSOs
CO1	PO5/PSO5
CO2	PO3/PSO4
CO3	PO3,PO5/PSO4
CO4	PO3,PO5/PSO4

CO5	PO3/PSO2
CO6	PO2/PSO4

BCAE0205: INTRODUCTION TO INTERNET OF THINGS

Objective: *The objective of the course is to vision and Introduction to IoT and understands State of the Art – IoT Architecture.*

Module No.	Content	Teaching Hours
I	<p>IoT Architecture-State of the Art – Introduction, State of the art, Architecture Reference Model- Introduction, Reference Model and architecture, IoT reference Model</p> <p>M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management</p> <p>M2M to IoT – A Market Perspective- Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies.</p>	26
II	<p>M2M to IoT-An Architectural Overview- Building architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.</p> <p>IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints- Introduction, Technical Design constraints- hardware is popular again, Data representation and visualization, Interaction and remote control. Industrial Automation- Service-oriented architecture-based device integration, SOCRADES: realizing the enterprise integrated Web of Things, IMC-AESOP: from the Web of Things to the Cloud of Things</p>	26

Text Books:

- Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, (2014), *“From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence”*, 1st edition., Academic Press.

Reference Books:

- Vijay Madiseti and ArshdeepBahga, (2014), *“Internet of Things (A Hands-on-Approach)”*, 1st edition., VPT, 2014.
- Francis daCosta, (2013), *“Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”*, 1st edition., Apress Publications.

Outcome: *By the end of the class, students will learn to:*

- CO1: Understand the vision of IoT from a global context.
- CO2: Determine the Market perspective of IoT.
- CO3: Use of Devices, Gateways and Data Management in IoT.
- CO4: Building state of the art architecture in IoT.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/PSOs
CO1	PO1,PO3/PSO1
CO2	PO2 /PSO4
CO3	PO5/PSO2
CO4	PO11/PSO2

BCAE0206: .NET FRAMEWORK USING VB .NET

Objective: The course objective is to get familiarize with Microsoft VB.Net technologies. The VB.Net course is designed to understand the different concepts and features of .NET coding, debugging and developing of Console, Windows and web applications in terms of Single and Multi-Tier architecture. This course emphasis on the fundamentals like language syntax, data and file structures, input/output devices, and files as well as advance feature such as Windows, Web services, Exception Management, Component Programming etc. which helps the students of design applications with rapid development approach.

Credits: 03

L-T-P: 3-0-0

Module No.	Content	Teaching Hours
I	<p>Introduction to .Net Framework: Architecture of .Net Framework, Features of .Net, Advantages of .Net, Common Language Runtime, Common Type System, Common Language Specification, MSIL.</p> <p>Introduction to Visual Basic.Net IDE: Creating a project, Types of project in .Net, Exploring and coding a project, Solution explorer, toolbox, properties window, Output window, Object Browser.</p> <p>VB.Net Programming Language: Similarities and Differences with Visual Basic, Variables, Comments, Data Types, Working with Data Structures – Arrays, Array Lists, Enumerations, Constants, Structures.</p> <p>Object Oriented Features: Classes and Objects, Access Specifiers: Private, Public and Protected, Building Classes, Reusability, Constructors, Inheritance, Overloading, Overriding, Creating and Using Namespaces.</p>	20
II	<p>VB.Net Programming Language: Introduction to procedures, calling procedures, argument passing mechanisms, scope of variable, conditional statement, Loops, Nesting of Loops, MsgBox and Input Box.</p> <p>GUI Programming: Introduction to Window Applications, Using Form – Common Controls, Properties, Methods and Events. Interacting with controls - Textbox, Label, Button, Listbox, Combobox, Checkbox, Picture Box, Radio Button, Panel, scroll bar, Timer, ListView, TreeView, toolbar, Status Bar. Dialog Controls, Creating and Using MDI applications, Toolbar, Status Bar, Creating custom controls, Creating Menus.</p> <p>Introduction to ADO: ADO vs ADO.Net, ADO.Net data namespaces, ADO.Net Object Model, Accessing data from Server Explorer, Creating Connection, Command, Data Adapter, Data Reader and Data Set with OLEDB and SQLDB, Data Binding.</p>	20

Text Book:

- Kogent, (2010), "Visual Basic Programming Black Book", Kogent Learning Solutions, Wiley India.
- Michael Halvorson, (2010), "Visual Basic- Step By Step", PHI.

Reference Books:

- EvangelosPetroutsos, (2010), "Mastering Microsoft Visual Basic", Wiley Publications.
- Wrox, (2010), "Beginning Visual Basic".

Outcome: After completion of course, student will be able to:

- CO1: Gain an understanding of the Microsoft .NET architecture.
- CO2: Gain a working knowledge of the VB.Net programming language and Learn how to build object-oriented applications using VB.Net.
- CO3: Gain a comprehensive understanding of the philosophy and architecture of VB.Net programming
- CO4: Attain a detailed working knowledge of VB.Net implicit types, object initializers, delegates, anonymous types & methods, extension methods and many more.

- *CO5: Acquire a working knowledge of creating and rich console, windows and web applications using the .NET Framework 4.0 and Visual Studio 2010.*
- *CO6: Configure and deploy a Microsoft Console and Windows application.*

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/PSOs
CO1	PO1,PO3/PSO1
CO2	PO2 /PSO4
CO3	PO3,PO5/PSO2
CO4	PO4/PSO2
CO5	PO4/PSO2
CO6	PO4,PO5/PSO2

BCAE0270: ADVANCED JAVA LAB

Objective: To implement various object-oriented programming concepts related to the java language by using Applet, Swing and JDBC,

Credits: 01

L-T-P: 0-0-2

Module No.	Content	Lab Hours
I/II	<p>Programs Based on the Concepts Collection Framework:</p> <ul style="list-style-type: none"> ● Generic Classes and Collection API. <p>Programs Based on the Concepts of Applet:</p> <ul style="list-style-type: none"> ● Write a program using Applet to display message in the Applet ● Write a program using Applet for configuring Applets by passing parameters. ● Write programs for using Graphics class <ul style="list-style-type: none"> -to display basic shapes and fill them -draw different items using basic shapes -set background and foreground colors <p>Programs Based on the Concepts of Event Handling:</p> <ul style="list-style-type: none"> ● Write a Java Program to demonstrate Action event ● Write a Java Program to demonstrate Mouse events <p>Programs Based on the Concepts of AWT and Swing Component:</p> <ul style="list-style-type: none"> ● Applet Programming, With GUI Development using AWT and Swings Handling Events On GUI Components. <p>Programs Based on the Concepts of JDBC:</p> <ul style="list-style-type: none"> ● Write Program to perform database operation ● Handling Database Connectivity With Java. <p>Programs Based on the Concepts of Servlet:</p> <ul style="list-style-type: none"> ● Write a program to demonstrate Basic Servlet ● A simple servlet that just generates plain text <p>Programs Based on the Concepts of JSP:</p> <ul style="list-style-type: none"> ● Write a program to demonstrate basic JSP example. ● Program for Database Operation in JSP. 	24

Text Book:

- Naughton Patrick, SchildHerbertz, (2011), "The Complete Reference -Java", TMH Publication, 7thedition..

Reference Books:

- Naughton Patric, Morrision Michel, (2006), "Java Hand Book", Osborne/McGraw-Hill, 5thedition..

Outcome: After completion of course, student will be able to:

- CO1: Use the Java SDK environment to create, debug and run simple Java programs.
- CO2: Create Java application programs using sound OOP practices (e.g., interfaces and APIs)
- CO3: Able to develop and deploy Applet in java.
- CO4: Create dynamic web pages, using Servlets and JSP.
- CO5: Learn to access database through Java programs, using Java Data Base Connectivity

(JDBC)

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/PSOs
CO1	PO1,PO2 /PSO1
CO2	PO1,PO2/PSO3
CO3	PO1,PO3/PSO1,PSO3
CO4	PO2,PO3/PSO2
CO5	PO1,PO3/PSO1,PSO2

BCAE0271: INTRODUCTION TO BIG DATA LAB

Objective: *The objective of this course is that students will have the knowledge to optimize business decisions and create competitive advantage with Big Data analytics.*

Credits: 01

L-T-P: 0-0-2

Module No.	Content	Lab Hours
I/II	<p>Basics of Hadoop</p> <ul style="list-style-type: none"> ● Perform setting up and Installing Hadoop in its two operating modes: Pseudo distributed & Fully distributed. ● Use web based tools to monitor your Hadoop setup. <p>Implement the following file management tasks in Hadoop:</p> <ul style="list-style-type: none"> ● Adding files and directories, Retrieving files, Deleting files ● Benchmark and stress test an Apache Hadoop cluster <p>Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm</p> <ul style="list-style-type: none"> ● Find the number of occurrence of each word appearing in the input file(s) ● Performing a MapReduce Job for word search count (look for specific keywords in a file) <p>Introduction to Hive</p> <ul style="list-style-type: none"> ● Use of primitive data types & collection data types <p>Hive Query Language</p> <ul style="list-style-type: none"> ● DDL (Data Definition Language) Statement ● DML (Data Manipulation Language) Statements 	24

Text Book:

- Jason Kolb, Jeremy Kolb, (2013), "*The Big Data Revolution*".

Reference Books:

- WAGmob, (2013), "*Big Data and Hadoop*", 1.5 edition..

Outcome: After completion of the course, the student will be

CO1: Familiar with *the solution* of Big Data

CO2: To implement the basic knowledge of design of Hadoop.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

Cos	Pos/PSOs
CO1	PO2,PO5/PSO4
CO2	PO1,PO5/PSO3

BCAE0272: VB .NET PROGRAMMING LAB

Objective: The student will use Visual Basic.Net to build Windows applications using structured and object-based programming techniques. Students will be exposed to the following concepts and/or skills at an introductory concepts level:

- Analyze program requirement.
- Design/develop programs with GUI interface.
- Code programs and develop interface using Visual Basic .Net
- Perform tests, resolve defects and revise existing code.

Credits: 01

L-T-P: 0-0-2

Module No.	Content	Lab Hours
I/II	<ul style="list-style-type: none"> ● Understanding about VB .NET Integrated Development Environment: How to create a project, Various types of project developed in VB .NET, Exploring and Coding a project, Solution explorer, Toolbox, Properties window, Output window, Object Browser. ● Programming in VB .NET: Develop programs related to Data Structures – Arrays, Array Lists, Enumerations, Constants, and Structures. ● Develop programs related to Procedures, Calling procedures, Argument passing mechanisms, Scope of variable, Conditional statement, Loops, Nesting of Loops, MsgBox and Input Box. ● GUI Programming: Develop various VB .NET Window Applications Using Windows Form – Common Controls, Properties, Methods and Events, Textbox, Label, Button, Listbox, Combobox, Checkbox, Picture Box, Radio Button, Panel, scroll bar, Timer, ListView, TreeView, toolbar, Status Bar. Dialog Controls, Creating and Using MDI applications, Toolbar, Status Bar, Creating custom controls, Creating Menus. ● Programming using ADO .NET: Develop various Database Windows applications using Connection, Command, Data Adapter, Data Reader and Data Set. 	24

Text Book:

- Kogent, (2010), “Visual Basic Programming Black Book”, Kogent Learning Solutions, Wiley India.
- Michael Halvorson, (2010), “Visual Basic 2010 Step By Step”, PHI.

Reference Books:

- EvangelosPetroutsos, (2010), “Mastering Microsoft Visual Basic”, Wiley Publications.
- Wrox, (2010), “Beginning Visual Basic”.

Outcomes:

- CO1: Logic Development to analyze the problem and design optimized solution using VB.Net.
- CO2: Create programs using Visual Basic (VB) code and .NET Framework classes.
- CO3: Be aware of the latest developments in VB and .NET.
- CO4: Recognize, describe and use the .NET Framework and its various classes.
- CO5: Develop applications of various categories like console, windows and web including the designing of windows and web services in the .NET.
- CO6: Apply data access technologies from within VB.NET.
- CO7: Develop simple to intermediate application using .NET, individually and as a team member.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs/PSOs
CO1	PO1,PO2 /PSO1
CO2	PO1,PO2/PSO3
CO3	PO1,PO3/PSO1,PSO3
CO4	PO2,PO3/PSO2
CO5	PO1,PO3/PSO1,PSO2
CO6	PO2/PSO3
CO7	PO1,PO3/

BCAJ0950: MINI PROJECT - I

Objective: To implement a computer language to build a software system to reduce the paper work

Semester IV

Credits: 01

L-T-P-J: 0-0-

Module No.	Content	Lab Hours
I	<p>Students are required to develop a real time application project comprising of minimum 1000 LOC on any platform in a modular structure. The development of the project must consist of the following :</p> <p>Project Planning – Schedule and Activity Estimation using MS Project 2000</p> <p>SRS in IEEE 830-1998 format</p> <p>Process Framework for development</p> <p>Software Design Document as per IEEE-1016</p> <p>Interfaces Detail and Component Level Design</p> <p>Test Cases development as per the stated Software requirement, which is further to be tested on any CASE tool.</p> <p>In order to obtain creativity, it is required that, the software must have minimal use of library/ library functions of respective language/ package</p>	24

Outcome:

- After completing the project, the students should gain an insight into the development process of real projects and understand the concepts of software products and software processes.

BCAJ0951: MINI PROJECT - II

Objective: To implement a computer language to build a software system to reduce the paper work

Semester V

Credits: 01

L-T-P-J: 0-0-

Module No.	Content	Lab Hours
I	<p>Students are required to develop a real time application project comprising of minimum 1000 LOC on any platform in a modular structure. The development of the project must consist of the following :</p> <p>Project Planning – Schedule and Activity Estimation using MS Project 2000</p> <p>SRS in IEEE 830-1998 format</p> <p>Process Framework for development</p> <p>Software Design Document as per IEEE-1016</p> <p>Interfaces Detail and Component Level Design</p> <p>Test Cases development as per the stated Software requirement, which is further to be tested on any CASE tool.</p> <p>In order to obtain creativity, it is required that, the software must have minimal use of library/ library functions of respective language/ package</p>	24

Outcome:

- After completing the project, the students should gain an insight into the development process of real projects and understand the concepts of software products and software processes.

BCAJ0971: MAJOR PROJECT

Objective: To implement a computer language to build a software system to reduce the paper work

Semester VI

Credits: 06

L-T-P-J: 0-0-

Module No.	Content	Lab Hours
I	<p>Students are required to develop a real time application project comprising of minimum 1000 LOC on any platform in a modular structure. The development of the project must consist of the following :</p> <p>Project Planning – Schedule and Activity Estimation using MS Project 2000</p> <p>SRS in IEEE 830-1998 format</p> <p>Process Framework for development</p> <p>Software Design Document as per IEEE-1016</p> <p>Interfaces Detail and Component Level Design</p> <p>Test Cases development as per the stated Software requirement, which is further to be tested on any CASE tool.</p> <p>In order to obtain creativity, it is required that, the software must have minimal use of library/ library functions of respective language/ package</p>	48

Outcome:

- After completing the project, the students should gain an insight into the development process of real projects and understand the concepts of software products and software processes.