BCA Course Details under CBCS

Semester- I			
Course Code	Course Title	Course Credits	AY
CAC-101	Problem Solving and Programming Concepts	4(T)	2019-20
CAC-102	Computer Organization and Architecture	4(T)	2019-20
CAC-103	Basic Mathematics	4(T)	2019-20
CAC-104	Problem Solving and Programming Laboratory	2(P)	2019-20
GE-101	GE To be selected by College from approved list	4(T)	
ESA-101	Environmental Studies-I	2(T)	2019-20
SEC-101	SEC To be selected by College from approved list	2 (P)	
	Total (Semester I)	22	
Semester – II			
Course Code	Course Title	Course Credits	AY
CAC-105	Data Structures	4(T)	2019-20
CAC-106	Operating Systems Concepts	4(T)	2019-20
CAC-107	Applied Mathematics	4(T)	2019-20
CAC-108	Data Structures Laboratory	2(P)	2019-20
GE-201	GE To be selected by College from approved list	4(T)	
ESA-102	Environmental Studies-II	2(T)	2019-20
SEC-201	SEC To be selected by College from approved list	2(P)	
	Total (Semester II)	22	

List of Generic Electives (GE)			
Course Code	Course Title	Course Credits	AY
CAG-101	Business Accounting	4(T)	2019-20
CAG-102	Cost Accounting	4(T)	2019-20
CAG-103	Advertising	4(T)	2019-20
CAG-104	Human Resource Management	4(T)	2019-20
CAG-105	Entrepreneurship Development	4(T)	2019-20
CAG-106	Marketing Fundamentals	4(T)	2019-20

List of Skill Enhancement Courses (SEC)			
Course Code	Course Title	Course Credits	AY
CAS-101	IT Tools Laboratory	2(P)	2019-20
CAS-102	Programming in Scratch	2(P)	2019-20
CAS-103	Digital Photography	2(P)	2019-20
CAS-104	Open Source Software	2(P)	2019-20
CAS-105	Operating Systems Laboratory	2(P)	2019-20
CAS-106	Programming in Python	2(P)	2019-20
CAS-107	HTML & CSS	2(P)	2019-20
CAS-108	PHP Programming	2(P)	2019-20

Semester III			
Course Code	Course Title	Course Credits	AY
CAC-109	Object Oriented Concepts	4(T)	2020-21
CAC-110	Database Management Systems	4(T)	2020-21
CAC-111	Object Oriented Programming Laboratory	2(P)	2020-21
CAC-112	Database Management Systems Laboratory	2(P)	2020-21
GE-301	GE To be selected by College from approved list	4(T)	
GE-302		4(T)	
CAA101	Communication and Presentation Skills	4(T)	2020-21
	Total (Semester III)	24	2020-21

Semester IV			
Course Code	Course Title	Course Credits	AY
CAC-113	Software Engineering	4(T)	2020-21
CAC-114	Data Communications	4(T)	2020-21
CAC-115	Case Tools Laboratory	2(P)	2020-21
CAC-116	User Interface Design Laboratory	2(P)	2020-21
GE-401	GE To be selected by College from approved list	4(T)	
GE-402		4(T)	

CAA102	Technical Writing Skills	4(T)	2020-21
	Total (Semester IV)	24	

Semester V			
Course Code	Course Title	Course Credits	AY
CAC-117	Web Technology	4(T)	2021-22
CAC-118	Information Systems	4(T)	2021-22
CAC-119	Web Technology Laboratory	2(P)	2021-22
DSE-501	DSE To be selected by College from the approved list	4(3T+1P)	
DSE-502		4(3T+1P)	
CAP-101	Project		2021-22
	Total (Semester V)	18	

Semester VI			
Course Code	Course Title	Course Credits	AY
CAC-120	Multimedia Technology	4(T)	2021-22
CAC-121	E-Commerce Applications	4(T)	2021-22
CAC-122	Multimedia Technology Laboratory	2(P)	2021-22
DSE-601	DSE To be selected by College from the approved list	4(3T+1P)	
DSE-602		4(3T+1P)	
CAP-101	Project	4	2021-22
	Total(Semester VI)	22	
	Overall BCA credits	132	

Discipline Specific Electives				
Course Code	Course Title	Semester	Course Credits	AY
CAD-101	Cyber Security	V	4(3T+1P)	2021-22
CAD-102	Virtualisation	V	4(3T+1P)	2021-22
CAD-103	Mobile Application Development	V	4(3T+1P)	2021-22
CAD-104	Computer Animation	V	4(3T+1P)	2021-22

CAD-105	Computer Graphics	V	4(3T+1P)	2021-22
CAD-106	Human Computer Interaction	V	4(3T+1P)	2021-22
CAD-107	3D Modelling and Animation	VI	4(3T+1P)	2021-22
CAD-108	Ethical Hacking	VI	4(3T+1P)	2021-22
CAD-109	Internet of Things	VI	4(3T+1P)	2021-22
CAD-110	Data Science Concepts	VI	4(3T+1P)	2021-22
CAD-111	Cloud Computing	VI	4(3T+1P)	2021-22
CAD-112	Content Management Systems	VI	4(3T+1P)	2021-22
CAD-113	Search Engine Optimisation	VI	4(3T+1P)	2021-22
CAD-114	Web Frameworks	VI	4(3T+1P)	2021-22

COURSE CODE : CAC-101

Total marks : 100	Total credits : 04

PROBLEM SOLVING AND PROGRAMMING CONCEPTS

Course Objective: To study the concepts of solving problems using a computer by designing programs as solutions

Unit		**Topic**		
#	**Title**	**#**	**Content**	**Learning Objectives**
I	**Evolution of programming languages**	A	Evolution of programming languages - Introduction to machine level language, Assembly language and Higher level languages.	To become familiar with the evolution of programming languages and know the strengths and weakness of each generation of language
II	**Computer Problem Solving**	A	Programing Life Cycle – Understanding the Problem Statement, Planning Program design using Hierarchy charts, Expressing Program logic using flowcharts / Pseudocode, Coding using a programing language such as	To understand the importance of each step in the programing life cycle and thereby learn to write structured and well documented modular programs.

			'C', Documenting, Compiling, Debugging and Executing	
		B	Structured / Goto Less Programming concept, Modular Programming - Top-Down Design, Bottom –up design , Stepwise Refinement	
III	**Computing concepts**	A	Data	To study the basic entity in computing
		B	Instruction	To know what is an instruction and the types of instructions
		C	Types of data : Integer, Floating-point, Character, String	To learn the different types of data that can be represented in programming
		D	Concept of a variable and the scope of variable	To learn about the data container
		E	Constant	To know the difference between varying and fixed data
		F	Arithmetic operators	To study the different operators available to write instructions
		G	Assignment operator	To know left hand and right hand evaluation of an instruction
		H	Flow of Control :Sequential flow and branching	To understand the execution sequence of a group of instructions
		I	Evaluation of expressions	To know the arithmetic behind evaluation of expressions
		J	Relational operators	To learn to relate and compare multiple data entities
IV	**Algorithm Development**	A	Definition	To know what an algorithm is and its origins
		B	Algorithm: a solution to a problem	To learn to use pseudo-code to design solutions
		C	Input-Output Statements	
		D	Decision Making Statements	
		E	Looping Statements	
		F	Examples	To get a practical hands on for writing pseudo-code
V	**Flowcharting**	A	Definition	

		B	Symbols	To study how to write the graphical representation of an algorithm to check flow of control
		C	Input-Output Statements	
		D	Decision Making Statements	
		E	Looping Statements	
		F	Module representation	
		G	Drawing conventions and standards	
		H	Examples	To thorough the nitty-gritties of flowcharting
VI	**Debugging**	A	Bug : Definition	To learn error detection and correction skills
		B	Types of errors : syntax , semantics and runtime	
		C	Program debugging	
VII	**Documentation**	A	**Definition**	To understand the purpose of documentation and naming of files and variables
		B	Comments and need for commenting	
		C	Documentation styles	
VI	**Programming**	A	Structure of a C Program, library functions, Preprocessor directives.	To understand the conversion of algorithms expressed using psuedocode / flowchart into computer program using C as the programing language.
		B	Constants, variables and keywords in C.	To learn the programming language specific constructs
		C	Type of arithmetic instruction, integer and float conversion. Data types in C.	To learn the programming specific data types and their usage.
		D	Decision control structure- if statement, if –else statement, nested if-else, switch case, use of logical operators.	To know the various decision control statements and compound conditional statements.
		E	The loop structure- while loop, for, do while. Use of break and continue statements. Menu driven programs using switch –case.	To use the different looping structures and to combine decision and looping structures

		F	Functions: passing values between functions. Scope of functions, function declaration and prototype, call by Value and Call by reference. Storage classes in C. Recursive functions.	To use the concept of modular programming.
		G	Arrays: one dimensional array, two dimensional arrays. Algorithm for String functions (strlen, strcpy,strcat, strcmp, strcmpi etc) using arrays. Functions and Arrays	To know static memory allocation for multiple data storage and its usage for string manipulation

References:

1. A Structured Programming Approach Using C, Behrouz A. Forouzan, RichardF. Gilberg ISBN:9788131500941, Cengage Learning India
2. Introduction to algorithms – Cormen, Leiserson, Rivest, Stein
3. The C Programming Language, Brian W. Kernighan, Dennis M. Ritchie,ISBN:9788120305960, PHI Learning
4. How to Solve it by Computer, R.G. Dromey, ISBN: 9788131705629, Pearson Education
5. Programming in ANSI C, E. Balaguruswamy, ISBN: 9781259004612, Tata Mc-Graw Hill Publishing Co Ltd.-New Delhi
6. Let us C : Yashwant Kanetkar

MOOCs:

NPTEL: http://nptel.ac.in/courses/106104128/

COURSE CODE : CAC-102				
Total marks : 100		Total credits : 04		
COMPUTER ORGANISATION AND ARCHITECTURE				
Course objective: The objective of this course is to provide a broad overview of architecture and functioning of computer systems and to learn the basic concepts behind the architecture and organization of computers.				
Unit		**Topic**		
#	**Title**	**#**	**Content**	**Learning outcomes**
I	**Introduction to Computer Organization and Architecture**	A	Computer-Definition and Block Diagram	To study the block diagram of the computer system
		B	Organization and architecture	To study the underlying structure and functioning of a computer
		C	Structure and Function	
		D	Computer Evolution and performance-History of computers, Von Neumann Architecture, Designing for performance, Pentium & PowerPC Evolution.	To learn the evolution of the computer with focus on the present day generation
		E	Computer Components, Computer Function	To study the different components of the computer with emphasis on their functioning
		F	Interconnection Structures, Bus Interconnection	The study the bus architectures and other different interconnection structures
II	**The Central Processing Unit**	A	Computer Arithmetic – ALU, Integer representation, Integer Representation – Addition, subtraction. Floating point representation – Addition, subtraction.	To study the representation of data and operations
		B	Instruction sets – characteristics & Functions, Addressing modes and formats.	To study the different Instruction sets, addressing modes and the data formats
		C	CPU structure and function	To study the structure of the CPU
		D	Processor Generation – 8086,Pentium I-IV,i1-i7	To understand the key features of the Processor Generations

III	**The Input/Output and File Subsystem**	A	I/O external devices	To study the different I/O peripheral devices
		B	I/O modules	To learn the functioning of the I/O modules
		C	I/O techniques (programmed, interrupt driven and DMA)	To study the different types of I/O techniques
		D	I/O Channels and processors	To learn about the different channels of I/O and its processors
		E	External interface	To study the external interfacing of I/O devices
		F	Operating system support	To know the relationship of I/O devices with OS
IV	**The Memory Subsystem**	A	Memory system overview	To study the storage systems
		B	Cache memory – Principle, elements of cache design, Pentium 4 and PowerPC cache organization	To know the functioning of the cache memory with emphasis on Pentium 4 and PowerPC architecture
		C	Internal Memory- Semiconductor main memory, Advanced DRAM organization	To learn the primary memory system
		D	External Memory- Magnetic Disk, RAID, Optical memory, Magnetic Tape	To study the secondary storage medium in detail with emphasis on features of each
V	**The Control Unit**	A	Structure of the Control Unit	To study the structure of the Control Unit
		B	Functioning of the Control Unit	To learn the functioning of the control unit
		C	Micro programmed control	To study micro programmed control unit

References –

1. Computer Organization and Architecture (7th Edition): William Stalling, Prentice-Hall.
2. Computer System Architecture: Morris Mano, Prentice-Hall.

E- Books:

1. Computer Organization: TMH, Ace series.

2. Computer Organization and Architecture by William Stallings, 5th Edition, Prentice-Hall

MOOCs:

1.NPTEL:http://nptel.ac.in/courses/106106092/

2. http://freevideolectures.com/Course/2277/Computer-Organization

COURSE CODE : CAC-103				
Total marks : 100		Total credits : 04		
BASIC MATHEMATICS				
Course objectives : To introduce basic fundamentals of mathematics				
Unit		**Topic**		
#	**Title**	**#**	**Content**	**Learning Objectives**
I	**Fundamentals of Mathematics**	A	Number Systems • Properties of integers and types • Divisor – proper & improper • Testing of primes • LCM and GCD	To study the properties of numbers with focus on operations to be performed
		B	Factorization	
		C	Ratio and Proportion	To represent ratio and proportion
		D	Quadratic Equations • Definition • Types • Roots and its nature	To evaluate quadratic equations and find its roots
II	**Logarithm and Indices**	A	Logarithm • Common Logarithm • Characteristics and mantissa • Antilogarithm	To learn to use logarithms and perform operations on logarithms
		B	Indices • Concepts • Properties • Laws	To study indices and its properties

III	**Mensuration**	A	Two dimensional • Area • Perimeter	To study mensuration with respect to 2D and 3D
		B	Three dimensional • Volume • Surface Area	
IV	**Complex Numbers**	A	Introduction Operations on Complex numbers • Addition • subtraction • multiplication • division • conjugate • modulus • reciprocal	To study representation of complex numbers and operations on complex numbers
		B	Representation • graphical • polar • vector	
		C	De Moiveor's Theorem	
		D	Nth roots of complex number • Basic properties • Square roots • Cube roots of unity	
V	**Matrices and Determinants**	A	Definition Types of matrices • Row • column • square • diagonal • scalar • unit • null • upper and lower	To study matrices , its properties and solving equations
		B	Properties of matrix Algebra of matrices • negative • transpose • equality • addition and subtraction • scalar multiplication, • Matrix multiplication • Adjoint	

			• Inverse	
		C	Solving non homogeneous ns by Matrix inverse d $X=A^{-1}B$	
		D	Determinants • Definition and order • Types • fundamental concepts • minor • co-factors • expansion value, • properties, • cramer's rule	To learn fundamental concepts of determinants and its properties
VI	**Sequence and Series**	A	Arithmetic Progression Geometric Progression Harmonic Progression	To study sequences and progressions
VII	**Coordinate Geometry**	A	Cartesian System • Coordinate of a point • Distance between points • Section formula • Area of triangle	To learn concepts of coordinate geometry with respect to straight lines and circle
		B	Straight Lines • Slope of a line • Parallel and Perpendicular lines • Angle between two intersecting lines • Equation of a straight lines(Through origin, Point slope from, two point form)	
		C	Circle • Standard form of a circle • circle with given radius and center	
VIII	**Trigonometry**	A	Introduction • Relation between degree and radian • Unit Circle definition	To learn trigonometric functions and identities
		B	Trigonometric function	

			Periodicity of trigonometric function	
		C	Trigonometric identities	
IX	**Limits & Continuity**	A	Introduction • Ordered pairs • Cartesian product • Relation • Function	To study limits, continuity and evaluation of limits
		B	Real function and types Domain and Range of function Composition of function	
		C	limit of a function Algebra of limits	
		D	Continuity of a function	
X	**Vectors**	A	Vectors in plane Cartesian coordinates Vectors in space	To study the concept of vectors, cross and dot products
		B	Dot products Cross products	

References:

1) Elementary Engineering Mathematics -B S Grewal
2) Calculus – Thomas Finney
3) Mathematical Techniques – Maria Ester Rebelo Abranches
4) Mathematics for computer- Neeta Mazumdar

COURSE CODE : CAC-104				
Total marks : 50		Total credits : 02		
PROBLEM SOLVING AND PROGRAMMING LABORATORY				
Course objective: To learn the process of computer problem solving and concepts through some programming language				
Unit		**Topic**		
#	**Title**	**#**	**Content**	**Learning Objectives**
I	**Programming Environment**	A	Integrated Development Environment	To understand some programming IDE and the different utilities
		B	Writing well documented programs that are easy understandable and modifiable.	To write well documented programs
		C	Program Life Cycle	To learn the phases of program development and execution
		D	Compilation/Interpretation	To learn program translation as applicable in the programming language
II	**Basic Programming Constructs**	A	Programs to understand basic Input/Output Statements	To learn the basic programming constructs by implementing them in a programming language
		B	Programs to understand the different data Types	To learn the programming specific data types and their usage.
		C	Understanding basic Programming constructs: Variables and Constants	To learn to declare variables and constants
		D	Using different logical and relational Operators	To learn Arithmetic, Relational, Logical, and other operators
		E	Understanding if, if-else, nested if-else, switch statements	To learn if/if..else and switch statements

		F	Understanding for, while, do while - looping statements. Also programs using break and continue statements	To understand the different looping structures and to combine decision and looping structures
		G	Understanding use of function with and without return types. Recursive functions.	To understand the concept of modular programming.
		H	Writing menu driven programs using loops and conditional statements	To implement simple algorithms as executable computer programs
VI	**Advanced Programming Constructs**	A	Programs using Arrays. 1-D and 2-D arrays. String manipulation functions, string manipulation using character arrays. Programs using Functions and arrays.	To know static memory allocation for multiple data storage and it's usage for string manipulation

References:

1. A Structured Programming Approach Using C, Behrouz A. Forouzan, RichardF. Gilberg ISBN:9788131500941, Cengage Learning India
2. Introduction to algorithms – Cormen, Leiserson, Rivest, Stein
3. The C Programming Language, Brian W. Kernighan, Dennis M. Ritchie,ISBN:9788120305960, PHI Learning
4. How to Solve it by Computer, R.G. Dromey, ISBN: 9788131705629, Pearson Education
5. Programming in ANSI C, E. Balaguruswamy, ISBN: 9781259004612, Tata Mc-Graw Hill Publishing Co Ltd.-New Delhi
6. Let us C : Yashwant Kanetkar

MOOCs:

NPTEL: http://nptel.ac.in/courses/106104128/

COURSE CODE : CAC-105	
Total marks : 100	Total credits : 04

DATA STRUCTURES

Course objectives :

To introduce concepts of data storage organization on computer, study the access mechanisms of data structures and their applications

Unit		**Topic**		
#	**Title**	**#**	**Content**	**Learning Objectives**
I	**Introduction to Data Structures**	A	Concept of a data structure	To understand the philosophy of a data structure
		B	Data type and data structure	To know the difference between the two
		C	Characteristics of data structures	To learn the properties such as access mechanism, complexity
		D	Space-Time trade offs	To study the efficiency considerations w.r.t. space
		E	Linear and non-linear data structures	To know differences between linear and non-linear structures
II	**Arrays**	A	Multi-dimensional arrays	To learn creation, operations on matrices
III	**Sorting and Searching Techniques**	A	Insertion Sort	To study the simple sorting algorithms
		B	Selection sort	
		C	Bubble Sort	
		D	Merge Sort	To study the advanced sorting algorithms advanced and their efficiency considerations
		E	Quick Sort	
		F	Heap Sort	
		G	Shell Sort	
		H	Linear Search	To study algorithms for searching data from a set
		I	Binary Search	
IV	**Stacks**	A	Concept of a LIFO	To study concept of a LIFO
		B	Stack operations	To learn operations and the abnormal conditions of a Stack

		C	Applications of Stacks in Computer Science	To apply the Stack data structure in implementing a LIFO
V	**Queues**	A	Concept of a FIFO	To study concept of a LIFO
		B	Queue operations	To learn operations and the abnormal conditions of a Queue
		C	Circular Queue	To study the concept and advantages of a circular queue
		D	Applications of Queue in computer science	To apply the Queue data structure in implementing a FIFO
	Linked Lists	A	Concept of a linear list	To study the concept of a list
		B	Singly linked list	To study the concept of a singly linked list with focus on its node structure and operations
		C	Doubly linked list	To study the concept of a singly linked list with focus on its node structure and operations
		D	Implementation of a stack and queue as a linked list	To learn to implement a stack using a singly linked list and a queue using a doubly linked list
	Trees	A	Concept of a tree data structure	To study non-linear data structures
		B	Binary tree	To study binary trees, node structure and creation of binary trees
		C	Binary tree Traversals	To study inorder /preorder /postorder traversals on a binary tree
		D	Binary Search Tree(BST)	To study concept of BST and its construction
		E	Construction of BST	
		F	Expression tree	To learn to represent an expression in a binary tree
		G	Construction of expression tree	
		H	Conversion of infix to pre/post fix • Manual method • Expression tree method	To learn to convert expressions from infix to prefix and postfix
		I	Heap tree	To study the concept of a heap and its construction

	Graphs	**A**	Graphs	To study the concept of a graph and its terminology
		B	Graph Terminologies • Vertex • Edge • Degree of a vertex	
		C	Types of Graphs • Directed/Undirected Graphs • Directed Acyclic Graph • Weighted Graphs	To study the different types of graphs
		D	Graph Representation • Adjacency matrix • Adjacency List	To learn to represent a graph using different representations
		E	Graph Traversals • DFS Traversal • BFS Traversal	To study the graph traversal methods
	Hashing	A	Concept of Hashing	To study the concept of hashing data storage
		B	Benefits & Limitations of Hashing	To learn the advantages and disadvantages of hashing in comparison to other methods

References:-

1. Behrouz A. Forouzan, RichardF. Gilberg, Data Structures – A Pseudocode Approach Using C, Cengage Learning India
2. Deepali Srivastava, Data Structures through C in Depth, BPB Publication
3. Tremblay .1 P, and Sorenson P G, Introduction to Data Structures and Applications, Tata McGraw-Hill,

MOOCs:

NPTEL: http://nptel.ac.in/courses/106102064/

COURSE CODE : CAC-106				
Total marks : 100		Total credits : 04		
OPERATING SYSTEMS CONCEPTS				
Course objectives : To study the modern day operating systems with emphasis on its functions and structure so as to enable students to decide the suitable operating system for specific job				
Unit		**Topic**		
#	**Title**	**#**	**Content**	**Learning Objectives**
I	**Introduction to Operating System**	**A**	Basic elements of a computer system • Processor • Main Memory • I/O Modules • System Bus Instruction Execution	To refresh the basic concepts with emphasis on operating systems
		B	Operating Systems • Definition • Evolution • Introduction to Major Functions/Services • OS Structure • Relationship between Kernel, OS, Hardware • Examples(For students to see and get a feel of OS)	To study the characteristics, functions and examples of operating systems with focus on its structure and organization
II	**Processes & Process Management**	A	Process • Definition • Process Control Block • Process States • Operations on Process	To understand the states and structure of a program in execution
		B	Threads and Microkernels • Definition • Multithreading Model	To study the concept of light weight processes and their execution

		C	Process Scheduling • Introduction to the Concept • Scheduling Criteria • Scheduling Algorithms • Multi-Processor Scheduling	To study allocation of resources for efficient throughput and maximum resource utilisation
		D	Concurrency/ Process Coordination • Synchronization • Principles • Mutual Exclusion • The Critical-Section Problem • Peterson's Solution • Semaphores • Monitors • Readers/Writers Problem	To learn process coordination and synchronization required in an operating system
		E	Deadlock • Principles • Deadlock Handling Methods • Prevention • Avoidance • Detection • Recovery From Deadlock	To familiarize the concept of a deadlock, its causes, prevention, avoidance and handling mechanisms
III	**Memory Management**	A	Memory Management Concepts • Introduction • Swapping • Contiguous Memory Allocation • Paging • Page Table • Segmentation	To study the basic issues in memory management as one of the function of an operating system
		B	Virtual Memory • Introduction • Demand Paging	To study the virtual memory concepts implemented in modern day operating systems

			• Page Replacement • Frames • Thrashing	
IV	**Input/ Output & File System**	A	File System • Concepts • File Organization and Access Methods • Directory Structure • File Sharing	To know the directory structuring and file access mechanisms
		B	I/O Management • I/O devices • I/O Hardware • Organization of I/O • I/O Buffering • Disk Structure, Attachment, Scheduling and Management • RAID	To study about the I/O devices and the way operating system manages them
V	**Security**	A	System Protection • Goals • Principles • Access Matrix	To know the reasons for security concerns and implementations
		B	Security • Types of Threats • Intruders • Cryptography • User Authentication • Trusted Systems	To study the different methods of implementing security in operating systems

References-

1. Modern Operating System by Andrew S. Tanenbaum, Prentice Hall, 3rd Edition, 2007.

2. Abraham Silberschatz and Peter Baer Galvin, "Operating System Concepts", 7th Edition, Pearson Education, 2002.

3. William Stallings, "Operating Systems", 6th Edition, Pearson Education, 2010.

4. Stuart, "Operating systems: Principles, Design and Implementation", 1st Edition 2008, Cengage Learning India

5. Schaum's Outline of Operating Systems (Schaum's Outline Series), by J. Archer Harris, Publisher: McGraw-Hill, 2001.

E-Books:

1. Operating Systems Guide :by Tim Bower

2. Operating Systems Course Notes: by Dr. John T.Bell

3. Schaum's Outline of Operating Systems (Schaum's Outline Series) [Kindle Edition] by J. Archer Harris.

MOOCs:

1. http://onlinevideolecture.com/?course=computer-science&subject=operating-systems

2. http://www.nptel.ac.in/courses/106108101/

COURSE CODE : CAC - 107

Total marks : 100	Total credits : 04

APPLIED MATHEMATICS

Objective: To introduce basic fundamentals of applied mathematics and understand its applications to solve real world problems

Unit		**Topic**		
#	**Title**	**#**	**Content**	**Learning Objectives**
I	**Number System**	**A**	Decimal Number System	To identify the different number systems used and be able to perform its various conversions from system to the other
		B	Binary Number System	
		C	Octal Number System	
		D	Hexadecimal Number System	
II	**Mathematical Logic**	**A**	Introduction to Logic	To learn the basic concepts of logic
		B	Logical Connectives	To study the various connectives used in logic reasoning
		C	Well formed formulas (WFF)	To design WFF using the logical connectives
		D	Tautology and Contradiction statements	To learn how to identify the tautology and contradictory statements in logic

		E	Converse and Contra positive statements	To identify the converse and contra positive statements in logic
		F	Equivalence Formulas	To be able to identify if the formulas are equivalent in nature through proofs
III	**Mathematical Induction**	A	Principle of Induction	To learn the principle of mathematical induction used in computer science
IV	**Boolean Algebra and Circuits**	A	Boolean Algebra • Introduction • Representation of Logic Variables: 0 and 1; Low and High; Off and On; No and Yes; Closed and Open Switch	To be able to represent the logic variable in various forms
		B	Truth table • Unary Operations: Logical Identity, Logical Negation • Binary Operations: Conjunction, Disjunction, Implication, Equality, Exclusive Disjunction, Logical NAND, Logical NOR • Applications: Logical Equivalences	To study various operations that be used along with the Boolean variables and will also be able construct truth tables for the same
		C	Boolean functions • Commutative Law • Associative Law • Distributive Law • Identity Law • Negation Law	To learn the various laws associated to the Boolean operations

		D	De-Morgan's theorem	
		E	Logic gates • AND, OR, NOT, NAND, NOR, XOR, XNOR • Logic Gate Diagram and Truth Table • Circuit Diagrams	To learn the basic fundamentals of digital electronics i.e. using logic gates and will be able to construct circuit diagrams from the same
V	**Set Theory**	A	Introduction to Sets	To learn to represent real world concepts using the basic concept of Sets
		B	Set Operations • Union • Intersection • Complement • Differences	To learn to use the various Set operations
		C	Algebraic Properties of Sets and De Morgan's Laws	To study the fundamental laws used in Set theory
		D	Venn diagrams	To learn to graphically represent the Sets used in problem solving
VI	**Relations**	A	Cartesian Product	To learn to implement Cartesian product
		B	Introduction to Relations	To learn concept of Relati
		C	Properties of Relations • Reflexive • Symmetric • Asymmetric • Anti-symmetric • Transitive	To learn various properties of Relation
		D	Equivalence Relation	To learn the Equivalence Relation
VII	**Functions**	A	Introduction to functions	To learn concept of functions
		B	Types of Functions • Identity function • Composite function • Injection (One-to-One) • Surjection (Onto) • Bijection (One-to-One and Onto) • Invertible	To learn the different types of functions

			• Composition of functions (fog, gof)	
VIII	**Permutations and Combinations**	A	Principle of counting	To learn the principle of counting
		B	Factorial Notation	To learn the concept of factorial
		C	Permutations i) Permutations with and without repetition ii) Circular Permutations	To learn to use permutations using its factorial form and in solving problems
		D	Combinations	To learn the concept of using combinations using its factorial form and in solving problems
IX	**Binomial Theorem**	A	Binomial Theorem	To learn the concept of using the Binomial theorem
X	**Principles of Counting**	A B	The Pigeonhole Principle The Inclusion-Exclusion Principle	To understand the Pigeonhole Principle and the Inclusion-Exclusion principle and apply it to real life situations in computer

COURSE CODE : CAC-108				
Total marks : 50		Total credits : 02		
DATA STRUCTURES LABORATORY				
Course objectives **:To learn different ways of organizing data encountered in real life applications.**				
Unit		**Topic**		
#	**Title**	**#**	**Content**	**Learning Objectives**
I	**Arrays**	B	Multi-dimensional Arrays Matrices	To implement programs using multi-dimensional arrays especially matrices
II	**Searching**	A	Linear Search	To implement searching algorithms over a list
		B	Binary Search	
III	**Sorting**	A	Bubble Sort	

		B	Insertion Sort	To implement simple sorting algorithms over an array of data elements
		C	Selection Sort	
		D	Merge Sort	To implement advanced sorting algorithms over an array of data elements
		E	Quick Sort	
		F	Shell Sort	
IV	**Stacks**	A	Stack Operations	To implement push , pop operations on a Stack by handling abnormal conditions of overflow and underflow
		B	Handling Stack Overflow/Underflow	
V	**Queues**	A	Queue Operations	To implement insert , delete operations on a Queue by handling the abnormal conditions of overflow and underflow
		B	Handling Queue Overflow/Underflow	
		C	Circular Queue	To implement a circular queue
VI	**Linked Lists**	A	Singly Linked List	To implement insert/delete operations at front end, rear end and in-between the singly linked list
		B	Doubly Linked List	To implement insert/delete operations at front end, rear end and in-between the doubly linked list
		C	Stack/Queue as Linked List	To implement a Stack as a singly linked list and a queue as a doubly linked list
VII	**Binary trees**	A	Construction of a Binary Search Tree	To create a BST and perform the traversals
		B	In/Pre/Post order Traversals	
VII	**Graphs**	A	Adjacency Matrix Representation and applications of graph	To construct a graph and representing it using the adjacency matrix representation

References:-

1. Behrouz A. Forouzan, RichardF. Gilberg, Data Structures – A Pseudocode Approach Using C, Cengage Learning India
2. Deepali Srivastava, Data Structures through C in Depth, BPB Publication
3. Tremblay .1 P, and Sorenson P G, Introduction to Data Structures and Applications, Tata McGraw-Hill,

MOOCs:

NPTEL: http://nptel.ac.in/courses/106102064/

COURSE CODE : CAG-101				
Total marks : 100		Total credits : 04		
BUSINESS ACCOUNTING				
Course objectives : To introduce concepts of financial accounting and management with a scope for applying these concepts into day to day tasks				
Unit		**Topic**		
#	**Title**	**#**	**Content**	**Learning Objectives**
I	**Introduction to Accounting**	A	Definition, scope of accounting	To study the basics of accounting
		B	Accounting as financial information system	
		C	Accounting Principles	
		D	Accounting Standards	
II	**Accounting procedure**	A	Transaction/event	To study the recording of financial business accounts
		B	Classification of accounts Voucher	
		C	Preparation of vouchers	
		D	Journal/ subsidiary books	
		E	Types of subsidiary books Ledger accounts and trial balance	
III	**Depreciation accounting, Capital & Revenue**	A	Expenditure & receipts	To understand the need for provisions and reserves
		B	Methods of depreciations • Straight-line method • Reducing method • Sinking fund method • Annuity Method • Machine hour rate method • Depletion method	
IV	**Company Final Accounts**	A	Preparation of trading a/c	To determine financial performance and financial position of a business
		B	Profit & Loss a/c	
		C	Balance sheet	

V	**Accounting for shares**	A	Kinds of shares	To understand the different types of shares
		B	Accounting for issue of shares	

COURSE CODE : CAG-102	**COURSE TITLE : COST ACCOUNTING**	
Total marks : 100	Total credits : 04	

Course prerequisites : **BUSINESS ACCOUNTING**

Course objectives: The objective of this paper is to provide in-depth knowledge of cost accounting as an important branch of accounting

Course contents :

Unit		**Topic**			**Weightage**		**References**
#	**Title**	**#**	**Content**	**Learning outcomes**	**hours**	**%**	
I	**Basic Concepts**	A	Introduction	To introduce the students to cost accounting as a branch of accounting and its objectives	15	20	Cost Accounting by S.P. Jain and K.L Narang 12th Edition Cost accounting by R.S.N. Pillai., V.Bagavathi Cost accounting by Arora
		B	Evolution and objectives of cost accounting				
		C	Importance of cost accounting	To understand the importance of cost accounting an organization			
		D	Difference between cost accounting and financial accounting	To understand how cost accounting differs from financial accounting			
		E	Cost concepts	To familiarize the students with the various cost concepts and classification of cost			
		F	Elements of cost & classification of cost				

		G	Preparation of cost sheet	To learn the preparation of cost sheet			
II	**Materials**	A	Introduction	To familiarize with the most important factor in the process of manufacturing i.e. Materials	15	24	Cost Accounting by S.P. Jain and K.L Narang 12th Edition
		B	• Material Procumbent procedure • Material issue procedure • Stores Record	To understand the material procurement and issue procedure in an organization			
		C	Inventory Control and inventory Levels • Maximum • Minimum • Reorder • Average level	To introduce the various inventory levels			
		D	Valuation of material receipts and issues Selection of pricing method • LIFO Method • FIFO Method • Simple Average • Weighted Average • Periodic Simple Average • Periodic Weighted Average • Standard Price Method	To familiarize with the various methods of Valuation of Materials			
III	**Labour**	A	Introduction to Labour	To familiarize with Labour as a factor of production	10	24	Cost Accounting by S.P. Jain and K.L Narang 12th Edition

		B	• Attendance and Pay roll Procedure • Preparation of Pay roll sheet • Idle time • Overtime • System of wage payment and incentive i. Time rate ii. Piece rate iii. Halsey plan iv. Rowan plan v. Taylor differential plan	To understand the preparation of wage sheet and the systems of incentives			
		C	Labour Turnover: Causes and How to Overcome Them	To understand the causes for labour turnover and absenteeism and how to avoid it in organizations			
IV	**Methods and techniques of Costing**	A	Introduction	To introduce the various methods of costing	20	32	Cost Accounting by S.P. Jain and K.L Narang 12th Edition
		B	• Job Costing • Batch Costing • Operating Costing,	To familiarize with Job Costing, Batch costing and Operating costing as methods of costing			
		C	Practical problems on • Contract costing • Process costing	To learn the preparation of Contract account and the various processes in manufacturing a product and how it is accounted for.			
		D	Techniques of costing • Standard Costing • Marginal Costing • Budgetary Control • Break even Analysis	To introduce the various techniques of costing			

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Course Code: - CAG-103

Course Title:- Advertising

Course Prerequisites: none

Course Objectives: To learn to the basic concepts of procedures and policies of advertising

Course Contents:

Introduction

Topics: History of Advertising, Advertising Ethics

Advertising Lifecycle

Topics: Finding a client, Get/Suggest a requirement, Idea and Pitching, Client Confirmation, Media Planning, Story Boarding, Scratch Audio Recording, Design / Creatives, Video Shoot, Audio Recording / Sound Design, Editing, Render, Follow-up

Architecture of an Advertising Firm

Topics: Management, Client Acquisition, Account Planning, Client Servicing, Media Management, Artiste Management, Creatives & Designs, Audio / Visual Team, Accounts, Administration, Technical

Advertising Types

Topics: Product Launch, Product Re-launch/ Image Change, Publicity

Market Research Methods

Media Planning

Topics: Channels of Distribution: Print- Magazines, Newspapers; Audio / Visual-Radio-Ads, Contests, Show Sponsoring; Television- Ads, Contests, Show Sponsoring. Web- Static / Flash Banners, Layered Ads, Interactive Ads, Contests/Games Virals

Advertising Campaigns

Topics: Basic Principles, Continuity, Re-emphasization, Progressive

Legal Aspects

Topics: Advertising Contracts, Copyrights & Trade Marks, Laws Affecting Advertising, Legal vs Ethical Standpoint Advertising Contracts, Copyrights & Trade Marks, Laws Affecting Advertising, Legal vs Ethical Standpoint

Advertising Media

Topics: Graphic Design: Manual, Computer Aided, Lettering & Typography, Photography, Audio: Sound Recording, Sound Design, Video Shoot, Editing

References -

1. Kotler and Armstrong, Principles of Marketing, PHI, N.Delhi

2. Stanton, Etzel and Bruce, Fundamentals of Marketing, McGraw Hill International

3. Ramaswamy V.S. and Namakumari S., Marketing Management – Planning Implementation and Control, Tata McGraw Hill Publication

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Course Code: - CAG-104

Course Title:- Human Resource Management

Course Prerequisites: none

Course Objectives: To introduce the different concepts of Human Resource Management within an organization

Course Contents:

Human Resource Planning

Learning Outcomes: To gain an insight into the contribution of HRM in an organization; The students will learn to plan the human resource requirements of an organization.

Topics: Meaning of Human Resource Planning, Definition of Human Resource Planning, Need of Human Resource Planning; Objectives, Scope, Benefits**;** Process of Human Resource

Planning

Recruitment and Selection

Learning Outcomes: The students will gain understanding of the recruitment policy and discuss the internal and external factors influencing recruitment decisions; gain a broad understanding of the importance of each part of the recruitment process and the possible danger spots; will understand the skills and knowledge needed to conduct fair selection of candidates in an organization; have a greater understanding on how a good or bad interview experience might impact an applicant; understand the contribution of Job analysis to organizational effectiveness and complete a job analysis in a given situation; understand the importance of Job enlargement and enrichment in organizations

Topics: Concept of Recruitment, Meaning and Definition of Recruitment, Sources of Recruitment, Internal Sources, External Sources, Advantages and Limitations; Process of Recruitment; Concept of Selection, Meaning and Definition, Process of Selection; Interviews: Meaning of Interview, Importance of Interview, Types of Interviews; Job Analysis: Meaning, Components, Job Description, Job Specification, Advantages of Job Analysis; Job Enrichment, Job Enlargement

Training and Performance Appraisal

Learning Outcomes: The students will get an insight into the benefits of Training employees; understand the various methods of training used for workers and managers; understand why it is important to effectively appraise performance of employees; will be able to describe the performance appraisal methods and the pros and cons of each; discuss the major problems inhibiting effective performance appraisals

Topics: Concept of Training, Meaning and Definition of Training, Importance of Training; Methods of Training: Methods of Training Managers, Methods of Training, Workers; On the Job Methods, Off-The Job Methods, Types of training; Meaning and Definition of Performance Appraisal, Objectives, Process of Performance Appraisal; Methods of Performance Appraisal, Traditional Methods, Modern Methods; Problems encountered in Performance Appraisal

Communication and Time Management

Learning Outcomes: The students will recognize the importance of business presentations and interpersonal skills and describe how good communication with others can influence our working relationships; understand the importance of time management for individuals and organizations

Topics: Meaning of Communication, Effective Business Presentations, Interpersonal Skills; Meaning and Nature of Time Management, Techniques of Time Management, Pareto's 80/20 Principle, Managing oneself and outside influences, Time Tabling and Planning

Career and Succession Planning

Learning Outcomes: The students will understand the need of planning a career in today's competitive world and the various opportunities available.

Topics: Meaning of Career and Career Planning, Need for Career Planning; Career Development Lifecycle, Career Opportunities

Counseling

Learning Outcomes: The students be able to understand the importance of counseling and the various types of counseling

Topics: Meaning of Counseling, Definition of Counseling, Objectives of Counseling, Need for Counseling**;** Types of Counseling**;** Steps in Counseling

References –

1. Industrial Organization and Management by N.G. Kale (TYBCOM)

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Course Code: CAG-105

Course Title:- Entrepreneurship Development

Course Prerequisites: None

Course Objectives: To provide students with substantial knowledge about the requirements of setting up a firm and exercising entrepreneurship skills.

Course Contents:

Introduction

Topics: Self employer, Entrepreneur, Intrapreneur, Entrepreneurship Development

Identification of Business Opportunities

Topics: Three stages- 1) Who am I?, 2) Study of Local Market, 3) Selection stage

Market Research

Topics: Meaning, Importance, Sources

Project Report

Topics: Meaning, Importance, Contents

Introduction of Managerial Skills

Topics: Human Resource Management, Financial Management, Marketing Management.

Purposeful Innovation

Topics: Seven sources of purposeful innovation, unexpected success / unexpected failure / unexpected event, Incongruities, Process need, Change in Industry/Market structure, Change in Demography, Change in perception, New knowledge.

References -

1. Bhattacharya S.N- Entrepreneurship Development in India & the South East countries – Metropolitan Book Comp.
2. Desai Arvind – Environment & Entrepreneurship – New Delhi, Ashish Publishing House - New Delhi
3. Dr. Deshpande Manohar – Entrepreneurship of Small Scale Industries – Deep & Deep Publication, New Delhi
4. Drucker Peter – Innovation & Entrepreneurship Affiliated East-West Press Pvt. Ltd.,- New Delhi
5. Khan M.A - Entrepreneurial Development Programmes in India – Kanishka Publishing

House, New Delhi.

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Course Code: - CAG-106

Course Title:- Marketing Fundamentals

Course Prerequisites: none

Course Objectives: To learn to the basic concepts of marketing.

Course Contents:

Introduction to Marketing

Topics: Meaning and Definition of Marketing - Importance of Marketing – Concepts of Marketing – Selling v/s Marketing. Market Segmentation – Meaning and Definition. Bases for Segmentation – Geographic, Demographic, Psychographic and Behaviouristic (meaning only). Marketing Mix – Meaning and Elements.

Designing Products

Topics: Meaning and Definition of Product – Classification of Products: Consumer goods and Industrial goods (in brief). Individual Product Decisions – a. Product Attribute Decisions b. Brand Decisions –Meaning and Definition of Brand, Brand Strategies and Brand Positioning c. Packaging and Labeling Decisions d. Product Support Decisions.

Pricing Products

Topics: Meaning and Definition of Price – Factors affecting pricing decisions. General Pricing Approaches – a. Cost-Based Pricing, b. Buyer-Based Pricing, c. Competition-Based Pricing. New Product Pricing Strategies – a. Skimming and b. Penetration

Placing Products

Topics: Meaning and Definition of Place – Components of Place – a. Distribution Channels b. Physical Distribution. Distribution Channels – Meaning and Importance - Number of Channel Levels – Factors affecting choice of a channel. Physical Distribution – Meaning and Nature of

Physical Distribution. Elements of Physical Distribution.

Promoting Products

Topics: Meaning and Definition of Promotion – Elements of Promotion – a. Advertising b. Sales Promotion c. Personal Selling d. Public Relations. Advertising – Meaning and Definition – Features – Advantages and Limitations. Sales Promotion – Meaning and Definition – Tools – Advantages and Limitations. Personal Selling – Meaning and Definition – Process – Advantages and Limitations. Public Relations - Meaning and Definition – Tools – Advantages and Limitations.

References –

1. Kotler and Armstrong, Principles of Marketing, PHI, N.Delhi

2. Stanton, Etzel and Bruce, Fundamentals of Marketing, McGraw Hill International

3. Ramaswamy V.S. and Namakumari S., Marketing Management – Planning Implementation and Control, Tata McGraw Hill Publication.

COURSE CODE : CAS -101				
Total marks : 50		Total credits : 02		
IT TOOLS LABORATORY				
Course objectives : To familiarize and learn use of various types of IT tools				
Unit		**Topic**		
#	**Title**	**#**	**Content**	**Learning Objectives**
I	**PC Setup**	A	PC Components Identification	To identify the different components of a PC
		B	PC Assembling	To study about the different peripherals connected to a PC
		C	BIOS Setup	To configure the BIOS setup for a standard PC
		D	PC Fault Troubleshooting	To learn to troubleshoot a PC
		E	PC Configuration	To learn to record and state configuration of a PC
II	**Office Productivity tools**	A	Word Processor	To learn the different features of a word processor
		B	Spreadsheet	To learn the different features of a spread sheet
		C	Presentation maker	To learn to use a presentation maker software
		D	Picture Manager	To learn simple image editing utilities
III	**Learning Management System**	A	**Basic Setup** • Installation of wampServer • Installation of Moodle LMS • Managing user accounts • Managing course settings • Logging in • Customizing your profile • Customizing course settings • Editing the header block	To learn the basic setup and customization of an LMS

			Posting a course syllabus & Lecture Slides	
		B	**Working with Resources** • Creating a text label • Linking to a web site • Creating a text page • Creating a web page • Linking to folder of documents **Working with Media** • Posting image files • Posting a photo gallery • Posting audio Posting video files	To learn to use the resources and other media in a LMS
		C	**Adding Activities** • Creating Assignments • Creating a forum • Creating a wiki • Creating Quiz	To learn to create different activities and exercises
		D	**Administration** • User Accounts (Student, Teacher, Course Creator, Administrator) • Editing, • Settings	To learn to configure and customize users, roles and associated settings
IV	**Internet Applications**	A	Using Web Browsers	To know how to configure a web browser
		B	Search Engines	To learn to use search engines by defining search criteria
		C	E-Mail	To learn to setup an e-mail account and send and receive e-mails
		D	Blogs	To learn to subscribe and post on a blog
		E	Torrents	To learn to use torrents for accelerated downloads

COURSE CODE : CAS -102	
Total marks : 50	Total credits : 02

Programming in Scratch				
Unit		**Topic**		
#	**Title**	**#**	**Content**	**Learning Objectives**
I	**UNIT 1**		Moving blocks, creating scripts, and repeating blocks	
II	**UNIT 2**		Drawing with a computer	
III	**UNIT 3**		Tempo, variables, and the hat block	
IV	**UNIT 4**		Coordinates and conditionals	
V	**UNIT 5**		Drawing with iteration	
VI	**UNIT 6**		Broadcast and random numbers	
VII	**UNIT 7**		Updating variables in repeats, iterative development, and the ask and join blocks	
VIII	**UNIT 8**		Scratch tools, gravity, and mazes	
IX	**UNIT 9**		Building your own blocks	
	UNIT 10		Strategies for games	

X				

COURSE CODE : CAS - 103	
Total marks : 50	Total credits : 02

Digital Photography

Unit		**Topic**		
#	**Title**	**#**	**Content**	**Learning Objectives**
I	**UNIT 1**		Introduction to Digital Photography	To learn and understand digital photography basics including the color palette and camera basics
II	**UNIT 2**		Photography basics including tools and palette	
III	**UNIT 3**		Factors to consider in a digital camera	
IV	**UNIT 4**		Photography vocabulary: aperture, shutter speed, ISO	
V	**UNIT 5**		Camera Metering & Camera Modes, Lenses and Optics	To understand the different camera modes its lenses and optics
VI	**UNIT 6**		Composition and Learning	To learn and understand how to See Ways to get images with strong composition
VII	**UNIT 7**		Learning the Photoshop and Lightroom workspace Toolbar and Option Bar	Basic understanding of photoshop and its toolbar

			Image Adjustments, Image Extensions Saving and sizing image	
VIII	**UNIT 8**		Lighting Techniques Natural vs. Artificial Lighting	Basic understanding of lighting techniques for indoor and outdoor shoots including natural and artificial lighting. Improving and developing the skill through various photo shoots as assignments and critically analyzing with the peers and experts.
IX	**UNIT 9**		Critiquing, analyzing and evaluating photography	
X	**UNIT 10**		Explore work by photographers	

COURSE CODE : CAS - 104

Total marks : 50	Total credits : 02

Open Source Software

Unit		**Topic**		
#	**Title**	**#**	**Content**	**Learning Objectives**
I	**UNIT 1**		The philosophy of OSS, commercial software vs OSS, free software vs freeware.	
II	**UNIT 2**		The Linux operating system, GPL, LGPL and other licenses	
III	**UNIT 3**		Categories of OSS Application Softwares	
IV	**UNIT 4**		Study of Commercial Application software vs OSS,	

V	**UNIT 5**		Open Office, GAMBAS, GIMP etc.	

References :

Understanding Open Source and Free Software Licensing – O'Reilly Media, 2011

Practicals :

- Find out various Open source software for the concepts studied by you till now.
- Install the software like Open office, MySQL etc. and perform comparative study of their salient features
-Use GIMP for Image Editing
- Use GAMBAS for creating Admission Forms
- Use GAMBAS for creating Exam Marksheet

COURSE CODE : CAS - 105

Total marks : 50	Total credits : 02

OPERATING SYSTEMS LABORATORY

Course objectives :To learn the setup, functioning and structure of desktop and advanced operating systems

Unit		**Topic**		
#	**Title**	**#**	**Content**	**Learning Objectives**
I	**Installation and configuration of Operating System**	A	Disk Partitioning	To learn disk preparation before installation
		B	Operating System Installation	To learn to install an Operating System
II	**Desktop based GUI Operating Systems**	A	Desktop	To learn to configure and customize the desktop
		B	Directory Explorer	To learn to navigate the file system using explorer
		C	Control Center	To learn to configure the operating system through the control panel
		D	Command Prompt Basic file and directory commands	To learn basic Commands
		E	Shell Programming	To learn to create shell scripts for common routine tasks
			Applications Installation	To learn to install an application
III		A	Introduction	To learn the concept of an online OS

	Web Based Operating System	B	Features	To learn the features of the online OS
		C	Configuration	To learn to configure and customize the operating system
		D	Resources	To learn to use the resources available
		E	File System	To learn file formats and directory structure
IV	**Network Configuration**	A	TCP/IP Configuration	To study network connectivity by configuring TCP/IP

COURSE CODE : CAS - 106

Total marks : 50	Total credits : 02

Programming with Python

Unit		**Topic**		
#	**Title**	**#**	**Content**	**Learning Objectives**
I	**Overview of Programming**			
		A	Structure of a Python Program,	To learn the basic programming constructs by implementing them in a programming language
		B	Elements of Python	
II	**Introduction to Python**	A	Python Interpreter,	To learn the programming specific data types and their usage, use of diffrent operators, declare variables
		B	Using Python as calculator, Python shell,	
		C	Indentation.	
		D	Atoms, Identifiers and keywords, Literals, Strings, Operators(Arithmetic operator, Relational operator, Logical or Boolean operator, Assignment, Operator, Ternary operator, Bit wise operator, Increment or Decrement operator)	
		E		
		F		

III	**Creating Python Programs**		**:**Input and Output Statements, Control statements(Branching, Looping, Conditional Statement, , nested conditions, Difference between break, continue and pass.), Defining Functions, default arguments, iteration and Recursion, Strings and lists	To learn and understand the use of if/if..else and switch statements, the different looping structures and to combine decision and looping structures, use of functions, recursion and iteration
IV	**OO programming, Data Structures overview**		Introduction to Classes, Objects and Methods, Arrays, list, set, stacks, queues	To implement classes, arrays, stacks and queues
V	**Sorting and searching tecniques**		Linear and Binary Search, Bubble, Selection and Insertion sorting	To implement the different sorting and searching techniques

COURSE CODE : CAS - 107

Total marks : 50	Total credits : 04

HTML & CSS

Unit		**Topic**		
#	**Title**	**#**	**Content**	**Learning Objectives**
I	**Web Designing Principles**	**A**	• Introduction • Why need of website designing • Golden Rule of web Designing • Page Design • Home Page layout • Design Concepts	Understand the importance of the web as a medium of communication. Understand the principles of creating an effective web page, including an in-depth consideration of information architecture.
II	**Basic of Web Design**	A	• Meaning of www • www Standards • W3C	

III	**Introduction to HTML**	A	• Web Servers • Web Clients • HTML TAGS • Paired Tags • Singular Tags	
		B	• Structure of HTML • Text Formatting • Heading Style • Text Style • text Effects	
IV	**Graphics in HTML**	A	• Border attribute • Width & Height • Align • DIV Tags	
V	**Tables** **& linking Documents**	A	• Table tags • Cell padding & spacing • Colspan & rowspan • External and Internal Links • Hyper Linking • Images ad Linking	
VI	**CSS**	A	• Concepts of css • Creating Stylesheets • Css Property & Stying • Id and class • Box Model • CSS Advanced(Grouping, Dimension, Display, • Positioning, Floating, Align,Pseudo class, Navigation Bar, • Image Sprites, Attribute sector) • CSS Color	

COURSE CODE : CAS - 108

Total marks : 50	Total credits : 02

PHP Programming

Unit		Topic		
#	Title	#	Content	Learning Objectives
I	**UNIT 1**		Design and write PHP programs- To learn Basic PHP syntax, structure and coding techniques, variables, constants, expressions and operators	
II	**UNIT 2**		Use of arrays, string, numbers, built-in functions and global variables	
III	**UNIT 3**		Use PHP to send email, upload files dynamically	
IV	**UNIT 4**		MySQL Database- setup, connection, insert, update, delete, display records	

References :

1. Steven Holzner, "PHP: The Complete Reference Paperback", McGraw Hill Education (India), 2007.
2. Timothy Boronczyk, Martin E. Psinas, "PHP and MYSQL (Create-Modify-Reuse)", Wiley India Private Limited, 2008.
3. Robin Nixon, "Learning PHP, MySQL, JavaScript, CSS & HTML5", 3rd Edition Paperback, O'reilly, 2014.
4. Luke Welling, Laura Thompson, PHP and MySQL Web Development", 4th Edition, Addition Paperback, Addison-Wesley Professsional,2008.
5. David Sklar, Adam Trachtenberg, "PHP Cookbook: Solutions & Examples for PHP Programmers", 2014.

Course code: ESA-101 **ENVIRONMENTAL STUDIES – I**

(No. of credits = 2; No. of contact hours = 30)

Semester – I (for B.C.A.)

Objectives: The course envisages that all the under graduates coming out of our University system are aware of our natural resources, ecosystems and their linkages to society, livelihood, environment and conservation. This theoretical learning shall be supported by the actual field visits.

Unit 1: The Multi-Disciplinary Nature of Environmental Studies (2 hours)

Definition, Scope and Importance; need for public awareness

Unit 2: Natural Resources: (8 hours)

- Renewable and Non-Renewable resources: natural resources and associated problems
  a) Forest Resources: use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
  b) Water Resources: use and over-exploitation of surface and ground water; floods, droughts, conflicts over water, dams-benefits and problems.
  c) Mineral Resources: use and exploitation, environmental effects of extracting and using mineral resources; case studies related to mining and its effect on siltation and loss of biodiversity.
  d) Food Resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity; case studies.
  e) Energy Resources: growing energy needs, renewable and non-renewable energy sources, use of alternative energy sources, case studies
  f) Land Resources: land as a resource, land degradation, man-induced landslides, coastal erosion, soil erosion and desertification.
- Role of an individual in conservation of natural resources.
- Equitable use of resources for sustainable lifestyles.

Unit 3: Ecosystems (6 hours)

Concept of an ecosystem, structure and functions of ecosystems; producers, consumers and decomposers, energy flow in the ecosystem, ecological succession, food chains, food webs and ecological pyramids.

Introduction, types, features, structure and functions of the following ecosystems: forest ecosystem, grassland ecosystem, desert ecosystem, aquatic ecosystem (ponds, streams, lakes, rivers, oceans, coastal zone, estuaries).

Unit 4: Biodiversity and its Conservation (8 hours)

Introduction, definition, genetic, species and ecosystem diversity; bio-geographical classification of India; value of biodiversity - consumptive use, productive use, social, ethical, aesthetic and option values; biodiversity at global, national, regional and local levels; India as a mega-diversity nation; hotspots of biodiversity; threats to biodiversity - habitat loss, poaching of wildlife, man-wildlife conflicts, bio-invasion, and over exploitation; endangered and endemic species of India (at least 5 examples of animals and plants each); conservation of biodiversity- in-situ and ex-situ conservation, role of biotechnology in conservation of biodiversity.

Unit 5: Field visits (6 hours)

Visit to a local area to document environmental assets - river/ forest/ grassland/ hill/ mountain; study of common plants, insects, birds; study of simple ecosystems-pond/ river/ hill slopes, etc. A report of field visit(s) to be maintained.

Recommended Readings

Agarwal K.C. (2001): Environmental Biology, Bikaner, Nidi
Bharucha E.: The Biodiversity of India, Ahmedabad, Mapin
Bharucha E.: Textbook of Environmental Studies. Orient BlackSwan
Brunner R.C. (1989): Hazardous Waste Incineration, New York, McGraw-Hill
Chatwal G.R. & Sharma H. (2005: A Textbook of Environmental Studies, Mumbai, Himalaya
Clark R.S.: Marine Pollution, Oxford, Clanderson
Cunningham W.P., Cooper T.H., Gorani E. & Hepworth M.T. (2001): Environmental Encyclopaedia, Mumbai, Jaico.
De A.K.: Environmental Chemistry, Wiley
Desai R.J. (2003): Environmental Studies, Mumbai, Vipul
Gleick H.P. (1993): Water in Crisis, Stockholm Envt. Institute, OUP
Hawkins R.E.: Encyclopaedia of Indian Natural History, Mumbai, BNHS
Heywood V.H. & Watson R.T. (1995): Environment Protection and Laws, Mumbai, Himalaya
Jadhav H. & Bhosale V.M. (1995): Environment Protection and Laws, Mumbai, Himalaya
McKiney M.L. & Schoel R.M. (1996): Environment Science, Systems and Solutions, Web Enhanced Edition.
Mhaskar A.K.: Matter Hazardous, Techno-Science Publications
Miller T.G. Jr.: Environmental Science, Wadsworth
Odum E.P. (1971): Fundamentals of Ecology, Philadelphia, W.B. Saunders
Rao M.N. & Datta A.K. (1986): Waste Water Treatment, Oxford & IBH
Santra S.C. (2004): Environmental Science, Kolkata, Central Book Agency
Sharma B.K. (2001): Environmental Chemistry, Meerut, Goel Publishing House
Townsend C., Harper J. & Begon M.: Essentials of Ecology, Blackwell Science
Trivedi R.K.: Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol.1 & 2, Enviro Media.
Trivedi R.K. & P.K. Goel: Introduction to Air Pollution, Techno-Science Publications
Wagner K.D. (1998) Environmental Management, Philadelphia, W.B. Saunders

Magazines

Down to Earth, Centre for Science & Environment
Survey of the Environment published by The Hindu

Eresource

http://www.ugc.ac.in/oldpdf/modelcurriculum/env.pdf

Course code: ESA-102 **ENVIRONMENTAL STUDIES – II**

(No. of credits = 2; No. of contact hours = 30)

Semester – II (for B.C.A.)

Objectives: The course envisages that all the under graduates coming out of our University system are aware of our natural resources, ecosystems and their linkages to society, livelihood, environment and conservation. This theoretical learning shall be supported by the actual field visits.

Unit 1: Environmental Pollution (7 hours)

Definition, causes, effects and measures to control air pollution, water pollution, soil pollution, marine pollution, noise pollution, thermal pollution, nuclear hazards; waste – types, causes, effects; waste management –solid, sewage and effluents; measures to control industrial and urban wastes; role of an individual in prevention of pollution; pollution case studies (Bhopal gas tragedy and mining); disaster mitigation and management-floods, droughts, earthquakes, landslides, cyclones, Tsunami.

Unit 2: Social issues and the Environment (8 hours)

From unsustainable to sustainable development; urban problems related to energy; water conservation, rainwater harvesting, watershed management; resettlement and rehabilitation of people - problems and concerns, case studies; environmental ethics - issues and concerns; climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies; wasteland reclamation; consumerism and associated waste products; Objectives and scope of Environment (Protection) Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Forest Conservation Act, Wildlife Protection Act, Forest Rights Act and Biodiversity Act; Issues involved in enforcement of environmental legislation; public awareness.

Unit 3: Human Population and the Environment (5 hours)

Population growth, variation among nations; population explosion - Family Welfare Programme; environment and human health; human rights; value education; HIV/AIDS; women and child welfare; role of Information Technology in environment and human health; case studies.

Unit 4: Tourism and Environment (4 hours)

Definition and typology of tourism; mass tourism and environment - aspects of degradation and exploitation, physical and social impacts; examples at local, regional, national and international levels. Sustainable tourism.

Unit 5: Field visit (6 hours)

Visit to a local polluted site - urban/rural/ industrial/ agricultural and waste treatment plant(s)/sustainable tourism site(s). A report of field visit to be maintained.

Recommended Readings

Agarwal K.C. (2001): Environmental Biology, Bikaner, Nidi
Bharucha E.: The Biodiversity of India, Ahmedabad, Mapin
Bharucha E.: Textbook of Environmental Studies. Orient BlackSwan
Brunner R.C. (1989): Hazardous Waste Incineration, New York, McGraw-Hill
Chatwal G.R. & Sharma H. (2005: A Textbook of Environmental Studies, Mumbai, Himalaya
Clark R.S.: Marine Pollution, Oxford, Clanderson
Cunningham W.P., Cooper T.H., Gorani E. & Hepworth M.T. (2001): Environmental Encyclopaedia, Mumbai, Jaico.
De A.K.: Environmental Chemistry, Wiley Desai R.J. (2003): Environmental Studies, Mumbai, Vipul
Gleick H.P. (1993): Water in Crisis, Stockholm Envt. Institute, OUP
Hawkins R.E.: Encyclopaedia of Indian Natural History, Mumbai, BNHS
Heywood V.H. & Watson R.T. (1995): Environment Protection and Laws, Mumbai, Himalaya
Jadhav H. & Bhosale V.M. (1995): Environment Protection and Laws, Mumbai, Himalaya
McKiney M.L. & Schoel R.M. (1996): Environment Science, Systems and Solutions, Web Enhanced Edition.
Mhaskar A.K.: Matter Hazardous, Techno-Science Publications
Miller T.G. Jr.: Environmental Science, Wadsworth
Odum E.P. (1971): Fundamentals of Ecology, Philadelphia, W.B. Saunders
Rao M.N. & Datta A.K. (1986): Waste Water Treatment, Oxford & IBH
Santra S.C. (2004): Environmental Science, Kolkata, Central Book Agency
Sharma B.K. (2001): Environmental Chemistry, Meerut, Goel Publishing House
Townsend C., Harper J. & Begon M.: Essentials of Ecology, Blackwell Science
Trivedi R.K.: Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol.1 & 2, Enviro Media.
Trivedi R.K. & P.K. Goel: Introduction to Air Pollution, Techno-Science Publications
Wagner K.D. (1998) Environmental Management, Philadelphia, W.B. Saunders

Magazines

Down to Earth, Centre for Science & Environment
Survey of the Environment published by The Hindu

Eresource

http://www.ugc.ac.in/oldpdf/modelcurriculum/env.pdf

Programme: B.C.A. SEMESTER III
Course Code: CAC109 **Title of the Course:** Object Oriented Concepts
Number of Credits: 04 **Effective from AY:** 2020-21

Prerequisites	Knowledge of Procedure Oriented Programming Language(C) and Data Structures using C
Objectives	**CO1.** To learn & understand the difference between Procedure Oriented and Object Oriented Programming Languages **CO2.** To learn & understand the Concepts of Object Oriented Programming Language **CO3.** To learn & understand Polymorphism, Inheritance and Exception handling

	CO4. To learn the basic concepts of UML.	
Content		**No. of Hours (60)**
Theory		**60**
1	**Introduction to OO Programming** • Introduction to Object- Oriented Programming • Problems/Limitations of Procedure-Oriented Programming • Comparison of Procedure Oriented And Object Oriented Paradigms • OO Programming Paradigms	**05**
2	**Objects, Classes and Relationship** • Introduction to Objects, Class, attributes • Abstraction • Introduction to UML. • Relationship between Classes/ Objects using class diagrams • Aggregation	**12**
3	**Designs with UML** Types of UML diagrams • Use case diagrams • Activity diagram • Sequence diagram • Statechart diagram • Object diagram	**16**
4	**Constructors, Destructors and Polymorphism** **Constructors** • Introduction • Types of Constructors Destructors **Function Overloading** • Introduction • Examples	**08**
5	**Inheritance** • Introduction • Derived classes • Private, Public and Protected members • Types Of Inheritance i.Single Inheritance ii.Multilevel Inheritance iii.Multiple Inheritance iv.Hierarchical Inheritance	**12**

	v.Hybrid Inheritance • Method overriding • Virtual base classes • Abstract classes • Interfaces	
6	**Exception Handling** • Introduction • Types of errors • Exception types • Exception Handling Mechanism : Using try catch and multiple catch Nested try, throw , throws and finally • Creating user defined Exceptions	**07**

Pedagogy	• At the start of course, the course delivery pattern, evaluation scheme, prerequisite will be discussed. • Lectures will be conducted with the aid of multi-media projector, black board, etc. • One internal written exam will be conducted as a part of internal theory evaluation. • One assignment based on the course content will be given to the students • The course has a separate laboratory (Object Oriented Laboratory), where students have an opportunity to build an appreciation for the concepts being taught in lectures. • Experiments shall be performed in the laboratory related to course contents as indicated in the syllabus.
Textbooks/ **Reference Books**	**Text Books:** 1. James Rumbaugh , Object Oriented Analysis and Design, Prentice Hall of India, New Delhi Publications, Edition 14 or later 2. E.Balagurusamy Object oriented Programming with Java; , Tata Mc Graw Hill publishing house, Edition 4 or later **Reference Books :** 1. Martin Fowler, UML Distilled by, Pearson Education, 3rd Edition or later 2. Herbert Schildt, The complete reference JAVA2; Tata Mc Graw Hill Publishing House, Edition 10 or later
Learning **Outcomes**	On completion of the course student will be able to LO1. Describe the meaning of OO paradigms LO2. Use concepts of OO programming for problem solving. LO3. Code basic programs LO4. Demonstrate the conceptual models of UML

Programme: B.C.A.
Course Code: CAC110 **Title of the Course:** Database Managements Systems
Number of Credits: 04 **Effective from AY:** 2020-21

Prerequisites	None
Objectives	**CO1.** To learn and Understand Data, Database and DBMS **CO2.** To learn Database Concepts **CO3.** To learn and understand the concepts of Data Models. **CO4.** To learn DDL and DML (SQL Concepts) **CO5.** To learn and design the database for an enterprise **CO6.** To learn how to organize, maintain & retrieve data effectively & efficiently **CO7.** To learn and implement recent changes in technology

	Content	**No. of Hours (60)**
1	**Introduction to DBMS** Basic Concepts: Database system, Database Management System • File oriented systems • Limitations of Traditional File Systems • Data independence • Database Architecture -Three-level Architecture • Data specification, security, integrity and access mechanisms • Data Definition Language (DDL) • Data Manipulation Language (DML) • Database Users • DBMS: Functions, Capabilities, Advantages and Disadvantages • Database Administration and Control	**06**
2	**Data models** • Brief overview of Hierarchical, Network, Relational, Object-relational and Object-oriented data models • Outline of the Data definition and data manipulation constructs in each of the above data models • Comparison of Data Models • Introduction to current Directions • Database Servers,ODBC • Client/Server Platform • Distributed databases • Data Warehousing and Data Mining	**06**
3	**Database Design Process** Database Design Approach • Conceptual modelling: Logical Model, Physical Model • Database Design tools • ER Concepts, Terminology, Diagrams • Mapping Conceptual model into relational schema • Concepts of keys • Entity integrity, Unique Requirement and Fundamental integrity rules: entity	**16 20**

	integrity, referential integrity	
4	**Data Normalization Process** Introduction to data normalization and normal forms • Benefits of normalization • NormalizationRules,1NF,2NF, 3NF and Higher NF • First Normal Form:1NF,Why convert to 1NF, Conversion to 1NF • Second Normal Form: 2NF Functional Dependency and Fully Functional Dependency Why convert to 2NF • Conversion to 2NF • Third Normal Form: 3NF Transitive Dependence why convert to 3NF Conversion to 3NF • Normalization considerations: Good and bad decompositions • Multi-valued dependencies and Join dependencies • Higher Normal Forms: Boyce- Codd NF, 4NF, 5NF, Domain- Key NF	**12 16**
5	**Transaction processing concepts** • Transaction processing system • Schedule, Recoverability, Serializability, locks • ACID Properties	**08**
6	**Emerging Trends in Database Technology** • Multimedia Database • Genome Database • Knowledge Database • Mobile Database	**04**

Pedagogy	• At the start of course, the course delivery pattern, evaluation scheme, prerequisite will be discussed. • Sessions to be conducted in the class with the aid of multi-media projector, etc. • One internal exam will be conducted as a part of internal evaluation. • assignment in the form of mini-project/ alternative mode will be given to the students. • Student activity can be conducted for teaching concepts ERD and Relational database concepts using Group Discussion and Flip Learning and any other such relevant method
Textbooks/ **Reference Books**	**Recommended Text Books:** 1. Ramez Elmasri and Shamkant B. Navathe, Fundamentals of Database Systems, Pearson Education, (5/e) or Later editions 2. Silberschatz, Korth, Data base System Concepts, McGraw Hill, 4th or later editions. **Reference Books :** 1. Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems (3/e), McGraw Hill. 2. Peter Rob and Carlos Coronel, Database Systesm- Design, Implementation and Management, Cengage Learning, (7/e)

Learning Outcomes	On completion of the course student will be able to **LO1.** Describe the fundamental elements of relational database management systems **LO2.** Describe the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL. **LO3.** Design ER-models to represent simple database application scenarios **LO4.** Convert the ER-model to relational tables, populate relational database and formulate SQL queries on data. **LO5.** Improve the database design by normalization. **LO6.** Describe basic database storage structures and access techniques: file and page organizations, indexing methods including B tree, and hashing. **LO7.** To learn and understand the future trends in Database Technology

Programme: B.C.A.
Course Code: CAC111 **Title of the Course:** Object Oriented Programming Laboratory
Number of Credits: 02(P) **Effective from AY:** 2020-21

Prerequisites	Knowledge of a Programming language.	
Objectives	**CO1.** Learn to Implement Java Programs **CO2.** Learn Use of Classes, Objects and Functions in Java **CO3.** To Learn various Object Oriented functionalities using Java **CO4.** Learn Exception Handling using Java.	
Content		**No. of Hours (60)**
1	**Introduction to Java - 06 Hours** Application/Use of language, Simple Programs, Data types, Control statements and Java Packages	06 04
2	**Classes and Objects in Java** Implementing Classes and objects, Array of Objects	08
3	**Methods in Java** Reading and writing data using methods ,Modes of Parameter passing, Return statement, String, MATH Functions in Java	07 08
4	**Constructors** Constructors: Default, Parameterized and Copy	0608
5	**Polymorphism**	0504

	Function Overloading	
6	**Inheritance in Java** • Single inheritance • Multilevel inheritance • Multiple inheritance • Hierarchical inheritance • Hybrid inheritance • Method Overriding in Java • Virtual base classes • Abstract classes	12
7	**Exception Handling in Java** • Syntax for Exception Handling, Throwing and Catching mechanism • User defined Exceptions	0604
8	**Vectors, Collections(Linked lists, hash maps)**	1012

Pedagogy	• At the start of course, the course delivery pattern, evaluation scheme, prerequisite will be discussed. • Sessions to be conducted in the laboratory with the aid of multi-media projector, etc. • One internal practical exam will be conducted as a part of internal evaluation. • One assignment in the form of mini-project/alternative mode will be given to the students. • Experiments shall be performed in the laboratory as indicated in the syllabus. • A softcopy of e-journal shall be maintained clearly mentioning the name of the experiment and other required information. It is to be submitted in the non-editable *.pdf* format at the end of the semester for evaluation.
Textbooks/ **Reference Books**	**Text Books :** 1. E.Balagurusamy, Object oriented programming with Java, , Tata Mc Graw Hill Publishing House, Edition 4 or later 2. Herbert schildt, The complete reference JAVA2, Tata Mc Graw Hill Publishing House, , 10th Edition or later
Learning Outcomes	On completion of the course student will be able to **LO1.** Implement object oriented designs with java. **LO2.** Design and program stand-alone java applications.

Programme: B.C.A.
Course Code: CAC112 **Title of the Course:** Database Management Systems Laboratory
Number of Credits: 02(P) **Effective from AY:** 2020-21

Prerequisites	Basic Concepts of Database management Systems
Objectives	**CO1.** To implement the relational database concepts, practically using some database management system software that can be used as a backend tool for an application

	Content	**No. of Hours (60)**
1	**Data Definition Language** • Database creation, alteration and deletion-To learn to create, alter and delete the database • Table creation, alteration and Deletion-To learn to create, alter and delete the table • Data Types-To learn to identify and assign the appropriate data types to the fields of the tables • Primary Key, Foreign Key, Domain Creation- To learn to identify and assign the appropriate keys to the fields of the tables	**10 12**
2	**Data Manipulation language** • Simple select query • Select with where clause • Group function and having clause • Operators • Functions • Aggregate Functions • Set operations • Sorting data **Sub query** • Returning single row • Returning multiple rows • Returning more than one column • Correlated sub query • Joining tables **Views**	**3028**
3	**Transaction Processing** • Start Transaction • Commit	**20**

	• Rollback • Save point • Locks • Triggers • Stored procedures **Database Privileges and Roles** • Grant • Revoke • Public	

Pedagogy	• At the start of course, the course delivery pattern, evaluation scheme, prerequisite will be discussed. • Sessions to be conducted in the laboratory with the aid of multi-media projector, etc. • One internal practical exam will be conducted as a part of internal evaluation. • One assignment in the form of mini-project/alternate mode will be given to the students. • Experiments shall be performed in the laboratory as indicated in the syllabus. • A softcopy of e-journal shall be maintained clearly mentioning the name of the experiment and other required information. It is to be submitted in the non-editable .pdf format at the end of the semester for evaluation.
Textbooks/ **Reference Books**	**Recommended Text Books:** 1. Du Bois , MYSQL, Sams, 5th Edition 2. Vaswani, MySql: The Complete Reference, McGraw Hill Education; 1st edition 3. MySQL user help manual
Learning **Outcomes**	On completion of the course student will be able to : **LO1.** Install, configure, and interact with a relational database management system; **LO2.** Design and implement a database schema for a given problem-domain. **LO3.** Normalize a database. **LO4.** Populate and query a database using SQL DML/DDL commands. **LO5.** Declare and enforce integrity constraints on a database using a state-of-the-art RDBMS. **LO6.** Learn and implement the principles and concepts of information integrity, security and confidentiality;

Programme: B.C.A.
Course Code: CAA101 **Title of the Course:** Communication & Presentation Skills
Number of Credits: 04 **Effective from AY:** 2020-21

Prerequisites	• None	
Objectives	CO1. To teach the process of interpersonal and group communication CO2. To develop skills of communication and idea presentation	
Content		**No. of Hours (60)**
1	**Fundamentals of communication** • The concept of communication • Communication process • Role of sender and receiver • Encoding, decoding feedback • How to achieve effective communication	**10**
2	**Types of communication** • Formal and informal communications • Horizontal, Vertical, Downward, Upward, communications • Grapevine • Consensus & Consultation • Methods of communication: Verbal, Face to face, Non- verbal	**10**
3	**Oral Communication** • Direct Face-to-Face verbal Communication • Remote Verbal Communication	**06**
4	**Interview Techniques** • How to prepare for an Interview • Types of Interviews • Candidates preparation for a Job Interview • Planning and Conducting a Job Interview • Advantages and drawbacks of Interviews	**12**
5	**Presentation Skills** • Preparation of a presentation • Matter researching • Understanding the audience • Placing plants within audience	**10**
6	**Methods of Presentation** • Use of technology • Presentation Softwares • Use of language, Gestures and Body language • Obtaining real –time feedback	**12**

Pedagogy	• At the start of course, the course delivery pattern, evaluation scheme, prerequisite will be discussed. • Sessions to be conducted in the class with the aid of multi-media projector, etc. • One internal exam will be conducted as a part of internal evaluation. • One assignment in the form of case study/ alternative mode will be given to the students. • Student activity can be conducted for teaching the concepts use role play, Group Discussion and Flip Learning and any other such relevant method
Textbooks/ **Reference Books**	**Recommended Text Books:** 1. Aspi Doctor & Rhoda Doctor, Principles and Practice of Business communication, 2. Urmila Rai, Business communication, Himalaya Publishing House-Mumbai 3. Dale Carvegie, Public Speaking and Influencing Men in Business, D B Taraporevala Sons & Co. Pvt. Ltd. 4. DR. C.S. Rajvinder, Communication, Himalaya Publishing House Mumbai 5. Geoffrey Moss, Persuasive Presentations, Vikas Publishing House Pvt. Ltd.
Learning **Outcomes**	On completion of the course student will **LO1.** Know the basic concept of communication and complete communication process **LO2.** Understand the aspects of effective, formal and informal communications **LO3.** Understand the different methods of communication **LO4.** Know the different forms of oral communication **LO5.** Know to prepare for an interview **LO6.** Know the process of conducting a job interview **LO7.** Know the aspects of presentation preparation **LO8.** Know the different forms of matter researching **LO9.** Study audience's frame of mind and manipulation techniques **LO10.** Know to use modern aids and software of presentation **LO11.** Know to use body language to assist better expression of thought **LO12.** Use real-time feedback for instant reaction

Goa University

Programme: B.C.A.
Course Code: CAC113 **Title of the Course:** Software Engineering
Number of Credits: 04 **Effective from AY:** 2020-21

Prerequisites	Knowledge of Structural and Object-Oriented Programming

Objectives	**CO1.** To learn & understand the Concepts of Software Engineering **CO2.** To learn & understand Software Development Life Cycle **CO3.** To learn & understand version control & release management concepts. **CO4.** To understand the agile approach of software development. **CO5.** To understand & apply agile approach using scrum framework & methodology. **CO6.** To understand & apply agile approach using XP framework & methodology. **CO7.** To learn various quality assurance concepts, approaches and tools. **CO8.** To know the basics of various modern and fourth generation software development techniques

	Content	**No. of Hours (60)**
	Theory	**60**
1	**Introductory concepts:** Introduction, definition, need, objectives, characteristics of good software, Software Development phases **Software Development Life cycle:** Definition, need, Model Types - Iterative Waterfall, Prototyping, Evolutionary, Spiral, Agile, Reverse engineering, reengineering	**05**
2	**Version Control:** Meaning, purposes, process & procedures, Concepts of versioning, check-in/checkout, cloning, commit, branching, merging, synchronization, conflicts, Tools (Git, Mercurial, Subversion, Beanstalk, BitBucket, GitHub, GitLab) **Release Management:** Meaning, purposes, process & procedures, Tools (Jenkins, Ansible, SaltStack, Chef, etc...)	**05**
3	**Agile Approach:** Agile Framework, Agile Manifesto, Agile Principles, Extreme Programming, Scrum	**08**
4	**Project Management with Scrum:** User stories, Estimation using story points, sprint, backlog(product and sprint), Scrum team, scrum artifacts, scrum ceremonies	**18**
5	**Design & Development using XP & TDD** TDD, refactoring (code smells and refactoring techniques) , Unit testing, Pair Programming	**10**
6	**Quality Assurance** Aim and objectives, verification - validation: Testing Levels & Testing Strategies • White Box - Static, Structural- functional, coverage & complexity	**10**

	• Black Box - Positive –Negative, Boundary Value Analyses, Decision Tables, Equivalence Partitioning, State Based • Integration - top-down, bottom-up, bi-directional • Introduction to system testing (functional and non-functional) • Introduction to Regression & Performance Testing	
7	**Modern Practices** Devops, continuous integration and continuous delivery (CI/CD), lean development, kanban	**04**
Pedagogy	• Course delivery pattern, evaluation scheme, prerequisite shall be discussed at the beginning. • Lectures preferably to be conducted with the aid of multi-media projector, black board, group activities, charts, cases, etc. • One internal written exam would be conducted as a part of internal theory evaluation. • One assignment based on the course content may be given to the students to evaluate how learning of objectives was achieved. It incorporates designing of problems, analysis of solutions submitted by the students groups. • The course has a separate laboratory, where students have an opportunity to build an appreciation for the concepts being taught in this course.	
Textbooks/ **Reference Books**	**Recommended Text Books:** 1. Jalote Pankaj, An Integrated Approach to Software Engineering, Narosa Publishing House, Third Edition 2. Chris Sims and Hillary Louise Johnson , Elements of Scrum, Dymaxicon, LLC 3. Martin Fowler, Refactoring, Addison Wesley; 2nd edition 4. Steve McConnell, Code Complete: A Practical Handbook of Software Construction, Microsoft Press, Second Edition **Recommended References:** 1. Ken Schwaber, Mike Beedle , Agile Software Development with Scrum, Pearson Education, 1st edition, 2014 2. S. Kenneth Rubin, Essential Scrum: A Practical Guide to the Most Popular Agile Process, Pearson Education, March 2015 edition 3. Mike Cohn, User Stories Applied: For Agile Software Development, Addison-Wesley Professional, 1st Edition 4. Kent Beck, Extreme Programming Explained: Embrace Change, Addison Wesley, 2nd Edition 5. Robert C Martin, Clean Code: A Handbook of Agile Software Craftsmanship, Prentice Hall, 1st Edition 6. Srinivasan Desikan and Gopalaswamy Ramesh, Software Testing-Principles and Practices, Pearson Education India, 2014 or later edition	
Learning	On completion of the course student will be able to	

Outcomes	**LO1.** Apply the software life cycle models & appreciate the development process **LO2.** Apply the concept of version control & release management **LO3.** Articulate the agile principles and practices. **LO4.** Perform scrum Release Planning, and Scrum Sprint Planning. **LO5.** Comfortably use XP framework for design and development of software. **LO6.** Comfortably apply the strategies and methods of software quality assurance **LO7.** Have a basic understanding of modern software development methodologies.

Goa University

Programme: B.C.A.
Course Code: CAC114 **Title of the Course:** Data Communications
Number of Credits: 04 **Effective from AY:** 2020-21

Prerequisites	• None	
Objectives	CO1. To learn and understand fundamentals of data communications. CO2. To understand the conceptual and analytical differences between Analog and Digital communication. CO3. To understand the network layered architecture and the protocol stack. CO4. To learn & understand Computer Networking essentials	
Content		**No. of Hours (60)**
Theory		**60**

1	**Introduction to Data Communication and Networks** • **What is Data Communication:** Characteristics, Components, Data Representation, Data Flow: Simplex, Half Duplex, Full Duplex. • **Networks:** Distributed Processing, Network Criteria, Physical Structures, Point-to-Point & Multipoint, Physical Topology. • **Categories of Networks:** LAN, MAN, WAN. Internetwork, The Internet Today. Protocols and Standards.	**08**
2	**Network Models** **Design Issues of the Layer, Protocol Hierarchy, ISO-OSI Reference Model:** unctions of each Layer. TCP/IP Protocol Suite: Functioning of Layers, How Transmission occurs from Sender to Receiver using layers in TCP/IP, Highlight usage of Protocols in Each Layer, Levels of Addressing.	**08**
3	**Link Layer** **Transmission Media, Guided Media (Wired**): Coaxial Cable: Physical Structure, Standards, BNC Connector, Applications, Twisted Pair: Physical Structure, UTP vs STP, Connectors, Applications. Fibre Optics Cable: Physical Structure, Propagation, Applications, Advantages & Disadvantages. **Unguided Media(Wireless):** Electromagnetic Spectrum for Wireless Communication, Propagation Methods, (Ground, Sky, Line-of-Sight); Wireless Transmission: Radio Waves, Infrared, Micro-wave; **Transmission technology:** Parallel and Serial Transmission, Base band and Broadband transmission, Signal Transmission, Digital signalling, Analog Signalling, Line Encoding Schemes: Manchester and Differential Manchester. Wireless LANs (IEEE 802.11), Bluetooth, Applications, (Wired Lan) Ethernet: Basic Features, Types of Ethernet, IEEE 802.3 Frame format. **Devices:** Hubs, Bridges and Repeaters.	**10**
4	**Internet Layer** **Logical Addresses (IPv4):** classful and classless Addressing, sub-netting. IPv4 vs IPv6. Network Address Translation (NAT), NAT and ISPs, Internetworking, Internet as a Datagram Network, Internet as a Connectionless Network, IPv4 Header. **Other Protocols:** ARP, RARP, ICMP. **Devices:** Routers	**10**
5	**Transport Layer:** Process-to-Process Delivery, Client/Server, Socket Addresses, Multiplexing and De-multiplexing, Connectionless vs Connection Oriented, and Reliable vs Unreliable. Importance of TCP/IP. **Protocols:** TCP and UDP, Header formats, Connections using TCP and UDP.	**12**
6	**Application Layer** **Internet:** Growth, Architecture, Accessing, Internet Service Providers (ISP). **Protocols:** DHCP, HTTP and HTTPS, DNS, DNS Translation, URL. **World Wide Web (WWW):** Web Servers, Web Browsers, Search Engine; Concept of Intranet & Extranet.	**04**

7	**Network Security:** Network security issues, approaches to network security, Ethical hacking. **Firewalls:** types of firewall technology- network level and application level, IP packets filter screening routers, limitations of firewalls. **Cryptography:** Introduction and Definition's, Encryption and Decryption using character substitution, Secret key Encryption, Public/Private key encryption. Overview of Digital Signature and Digital Certificates technology	**06**
8	**Network Setup** Network building blocks required for setting up a small LAN in an office, Hardware & software required, Simple Installation and configuration of Networking. Some basic networking configuration using Server and clients, Simple network administration.	**02**

Pedagogy	• Course delivery pattern, evaluation scheme, prerequisite shall be discussed at the beginning.
	• Lectures preferably to be conducted with the aid of multi-media projector, black board, group activities, charts, cases, etc.
	• One internal written exam would be conducted as a part of internal theory evaluation.
	• One assignment based on the course content may be given to the students to problems, analysis of solutions submitted by the student's groups.
	• For example:
	  • Learn the functioning of various network devices used in your college network
	  • Compare 2G,3G,4G and 5G networks
	  • Prepare LAN deployment diagram of your organization

Textbooks/ **Reference Books**	**Recommended Text Books:** 1. B.A. Forouzan; Data Communication and Networking; Tata McGraw Hill, 4/e 2. William Stallings; Data and Computer Communication; Pearson Education,7/e. 3. J.S Katre; Computer Network Technology; Tech-Max Publications; 2010. 4. Fred Halsall; Data Communications, Computer Networks and Open Systems; Addison Wesley; 3/e. 5. D.P.Nagpal; Data Communication and Networking; S. Chand;1/e **Recommended References:** 1. Andrew S. Tanenbaum, "Computer Networks", Pearson, Fourth Edition, 2003 2. Bhushan Trivedi, "Computer Networks", Oxford University Press 3. James F. Kuross, Keith W. Ross, "Computer Networking, A Top-Down Approach Featuring the Internet", Third Edition, Addison Wesley, 2004. 4. Nader F. Mir, "Computer and Communication Networks", Pearson Education, 2007

	5. Comer, "Computer Networks and Internets with Internet Applications", Fourth Edition, Pearson Education, 2003. 6. William Stallings, "Data and Computer Communication", Sixth Edition, Pearson, 2000 7. Norton Peter, Complete Guide to Networking, SAMS Publishing. 8. S.K.Basandra & S. Jaiswal, "Local Area Networks", Galgotia Publications **NPTEL Courses** 1. NPTEL: https://nptel.ac.in/courses/106/105/106105183/ 2. NPTEL: https://nptel.ac.in/courses/106/105/106105082/
Learning Outcomes	On completion of the course student will be able to **LO1.** Understand the basic concepts of data communication components used at various transmission speeds. **LO2.** Explain the different network topologies and their advantages and disadvantages. **LO3.** Explain how to build a network model and why. **LO4.** Understand how data could be encoded to digital bits. **LO5.** Identify different types of Transmission Mediums. **LO6.** Recognize the different internetworking devices and their functions. **LO7.** Explain Networking essentials and protocols governing the web

Goa University

Programme: B.C.A.
Course Code: CAC115 **Title of the Course:** CASE Tools Laboratory
Number of Credits: 02 **Effective from AY:** 2020-21

Prerequisites	None	
Objectives	**CO1.** Learn to use centralised repositories and versioning tool **CO2.** Learn to design and execute unit test cases using any testing tool. **CO3.** Learn to document code and generate documentation using documentation tool. **CO4.** Learn to use tool/s for debugging and defect tracking. **CO5.** Learn to apply code refactoring **CO6.** Understand and apply scrum methodology **CO7.** Learn and understand testing tool to test web application. **CO8.** Learn to use build tool to build application.	
Content		**No. of Hours**

		(60)
1	**Version Control Tool** • Study of any version control tool (e.g. Git)	**08**
2	**Unit Testing** • Study of any unit testing tool (e.g. JUnit, NUnit)	**04**
3	**Code Documentation Tool** • Study of any code documentation tool (e.g. Javadoc,)	**04**
4	**Debugging and defect tracking** • Study of any bug tracking tool (e.g. Bugzilla, bugbit)	**08**
5	**Code Refactoring** • use pair programming strategies	**08**
6	**Scrum methodology** • Burndown charts, Scrum board, Trello, • User stories, Estimation	**16**
7	**Web application Testing Tool** • Study of any web application testing Tool (e.g. Selenium	**08**
8	**Build Tool** • Study of any build tool (e.g. Maven)	**04**

Pedagogy	• Course delivery pattern, evaluation scheme, prerequisite shall be discussed at the beginning. • Practical sessions to be conducted using any appropriate/suitable tool/software, activity board, group activities, charts, cases, etc. • One internal written exam would be conducted as a part of internal evaluation. • One assignment in the form of mini-project may be given to the students to evaluate how learning of objectives was practically achieved. It incorporates designing of problems, analysis of solutions submitted by the students groups. • A softcopy of e-journal shall be maintained clearly mentioning the name of the experiment and other required information. It is to be submitted in the non-editable .pdf format at the end of the semester for evaluation. • For the purpose of work record, repository (git or any other) may be encouraged to be used by the students.

Textbooks/ **Reference Books**	**Recommended Text Books:** 1. Jalote Pankaj, An Integrated Approach to Software Engineering, Narosa Publishing House, Third Edition 2. Chris Sims and Hillary Louise Johnson , Elements of Scrum, Dymaxicon, LLC 3. Martin Fowler, Refactoring, Addison Wesley; 2nd edition 4. Steve McConnell, Code Complete: A Practical Handbook of Software Construction, Microsoft Press, Second Edition 5. Rahul Shende , Testing in 30+ Open Source Tools, Shroff Publishers & Distributor Pvt. Ltd **Recommended References:** 1. Ken Schwaber, Mike Beedle , Agile Software Development with Scrum, Pearson Education, 1st edition, 2014 2. S. Kenneth Rubin, Essential Scrum: A Practical Guide to the Most Popular Agile Process, Pearson Education, March 2015 edition 3. Mike Cohn, User Stories Applied: For Agile Software Development, Addison-Wesley Professional, 1st Edition 4. Kent Beck, Extreme Programming Explained: Embrace Change, Addison Wesley, 2nd Edition 5. Robert C Martin, Clean Code: A Handbook of Agile Software Craftsmanship, Prentice Hall, 1st Edition 6. Srinivasan Desikan and Gopalaswamy Ramesh, Software Testing-Principles and Practices, Pearson Education India, 2014 or later edition **Recommended Web References :** 1. git-scm.com/doc 2. junit-tools.org/index.php/getting-started 3. oracle.com/technetwork/java/javase/documentation/javadoc-137458.html 4. bugzilla.org/docs/2.16/html/how.html 5. tutorialspoint.com/bugzilla/index.htm 6. maven.apache.org/guides/getting-started/maven-in-five-minutes.html 7. javatpoint.com/maven-tutorial 8. orchardcollaboration.com/documentation 9. openproject.org/ 10. seleniumhq.org/

	11. sourceforge.net/projects/sahi/ 12. testng.org/doc/index.html
Learning Outcomes	On completion of the course student will be able to **LO1.** Proficiently use the centralized repositories and versioning tool. **LO2.** Comfortably design and execute test cases using testing tool. **LO3.** Create effective code documentation using tools **LO4.** Demonstrate proficiency in using debugging and defect tracking tool. **LO5.** Perform refactoring of the code using tools efficiently. **LO6.** Demonstrate the understanding of entry level scrum agile methodology of Software Development. **LO7.** Efficiently use tool/s to test web application. **LO8.** Comfortably use tool/s to build application.

Goa University

Programme: B.C.A.
Course Code: CAC115 **Title of the Course:** User Interface Design Lab
Number of Credits: 02(P) **Effective from AY:** 2020-21

Prerequisites	• Basic understanding of using internet and web browser.
Objectives	CO1. Identify the target audience and create user personas to create an audience-appropriate interface design. CO2. Construct a user-interaction strategy for a given problem. CO3. Sketch a series of graphical user-interfaces for a given use scenario.

	CO4. Implement a designed user-interface to demonstrate its functionality and usability. CO5. Design and Implement Web Interfaces

	Content	No. of Hours (60)
1	**Fundamentals of UI/UX** • User interface: Human–Computer Interface, Characteristics of Graphics Interface, User Interface(UI), User Experience(UX)	04
2	**Components of GUI** • Text Boxes, Combo Boxes, Password Boxes , Check Boxes, Grid, Lists, Dialog Boxes, Command Buttons, Radio Buttons, Sliders, Progress Bars, Frames • Exercises to observe and record different components of a graphical interface	04
3	**Events and Form Processing** Types of events • Click, Double Click, KeyPress, MouseMove • Exercises to test each event Form processing • Planning the layout of forms for accepting user input and using appropriate controls for data input • Form validation • Database connectivity • Exercise to design forms and perform form validations, error handling and database connectivity	12
4	**Web interfaces** • Introduction to HTML: !DOCTYPE, Meta tags, Formatting tags, Semantic tags, Image tag, Table tag, iframe, Form elements, working with canvas, image format, media: audio & video, Wireframing for websites • CSS Syntax, style tag, inline, internal, external, cascading order, !important tag • Styling: color codes, background, gradient, text, text effects, font, links, CSS borders, lists and tables, CSS id and class, CSS Box Model, CSS Pseudo-class, CSS pseudo-element, CSS selectors, CSS image, opacity, sprites, media types, align, position, float, CSS media queries	24

5	**Reports** • Planning the Layout of a report • Using suitable controls to display information using reports • Exercises to use reports to display information, based on data retrieved from the database	06
6	**Programming** • Graphical Interface designing using a programming language • Exercise to demonstrate usage of all the constructs of the programming language	06
7	**WYSIWYG** • WYSIWYG IDE: panels, tool bars, shortcuts, design, code and manage websites	04

Pedagogy	• Course delivery pattern, evaluation scheme, prerequisite shall be discussed at the beginning. • Sessions to be conducted in the laboratory with the aid of multi-media projector, etc. • One internal practical exam will be conducted as a part of internal evaluation. • One assignment in the form of mini-project will be given to the students. • Experiments shall be performed in the laboratory as indicated in the syllabus. • A softcopy of e-journal shall be maintained clearly mentioning the name of the experiment and other required information.
Textbooks/ **Reference Books**	**Text Books:** 1. D. Benyon, Designing Interactive Systems: A Comprehensive Guide to HCI and Interaction Design, Addison Wesley (4th Ed) 2019 2. H. Sharp, Y Rogers and J Preece, Interaction Design: Beyond Human-Computer Interaction, John Wiley (5h Ed)2019 **Reference Books:** 1. M.Harwani , Qt5 Python GUI Programming Cookbook: Building responsive and powerful cross-platform applications ; Packt Publishing Limited 2. Programming the Web with Visual Basic .NET; Constance Petersen; Lynn Torkelson, Apress 1. Chris Sells, Ian Griffiths, Programming WPF: Building Windows UI with Windows Presentation Foundation; Oreilly 2. S. Krug Don't Make Me Think, Revisited: A Common Sense Approach to Web Usability; New Riders 2013

	3. A. Cooper About Face: The Essentials of Interaction Design, John Wiley & Sons (2014) 4. Simon Robinson,There's Not an App for That – Mobile User Experience Design for Life, Morgan Kaufmann 5. Ben Frain , Responsive Web Design with HTML5 and CSS3; Ingram Short Title 6. Thoriq Firdaus, Ben Frain, Benjamin LaGrone, HTML5 and CSS3: Building Responsive Websites; Packt Publishing
Learning Outcomes	On completion of the course student will be able to **LO1.** Apply design principles, guidelines, and heuristics to create a user-interaction strategy that solves a real-world problem. **LO2.** Design a usable and compelling user-interface given a set of requirements and available technologies. **LO3.** Design a user interface from inception through the beginning development stage of Stand-alone app/Web app/mobile device app

Goa University

Programme: B.C.A.
Course Code: CAA103 **Title of the Course:** Technical Writing Skills
Number of Credits: 04 **Effective from AY:** 2020-21

Prerequisites	None	
Objectives	**CO1**. To learn to document and report matter using technical jargon especially using the English language as the reporting medium	
Content		**No. of Hours**

		(60)
1	**Introduction to Written Communication** • Principles of Commercial correspondence • Language in a business letter including Jargon • Letter Writing Basics • Layouts of Business Letters • Parts of a Business Letter	**15**
2	**Letters** • Formal Letters • RTI (Right to Information) LETTERS • Testimonials • References • Memos • Job Application Letters • Appointment Letters • Acceptance Letters • Resumes • Resignation Letters	**15**
3	**Media Related Writing** • Press Releases and articles for the press • Advertisements • E-mail and Netiquette • Classified Advertisements • Tender Notices	**15**
4	**Report Writing** • Introduction • How to collect data for a report • Kinds of Reports • What a Report usually contains • Reports written by individuals • Committee Reports • Evaluation of a Report • Report writing : Case study	**15**
Pedagogy	• At the start of course, the course delivery pattern, evaluation scheme, prerequisite will be discussed. • Sessions to be conducted in the class with the aid of multi-media projector, etc. • One internal exam will be conducted as a part of internal evaluation. • One assignment in the form of case study/ alternative mode will be given to the students. • Student activity can be conducted for teaching the concepts use role play, Group Discussion and Flip Learning and any other such relevant method	
Textbooks/	**Textbook :** 1. Aspi Doctor & Rhoda Doctor, Principles and Practice of Business	

Reference Books	communication, Sheth Publishers Private Limited
Learning Outcomes	On completion of the course student will be able to **LO1.** Learn the principles of correspondence and jargon for business letters **LO2.** Learn the conventions, formats of business letter writing **LO3.** Learn to write formal letters **LO4.** Learning the format and requirements of drafting an RTI letter **LO5.** Write different types of documents **LO6.** Understand the differences between types of letters **LO7.** Learn to draft media articles depending on their types **LO8.** Learn to draft an effective advertisement & concise classified ads **LO9.** Understand the rules and conventions of online correspondence **LO10.** Draft tender notices for formal intimations **LO11.** Learn to collect data from meetings, briefings and prepare a report **LO12.** Develop effective report writing skills

Goa University

Programme: B.C.A.

Course Code: CAC117 **Title of the Course: Web Technology**

Number of Credits: 04 **Effective from AY:** 2021-22

Prerequisites Basic understanding of using internet and web browser

Objectives **CO1**: Set foundation to build web applications using different web technologies.

CO2: Learn about client/server architectures and protocols

CO3: Learn how to represent web data using XML

	Content	**No. of Hours (60)**
1	**Introduction to Web Technology** • Internet, world wide web, web 2.0 • Client/Server paradigm • Protocols (TCP, IP, UDP, HTTP, HTTPS, FTP, TFTP, SMTP, MIME) • Functions and features of web servers and web browsers	04
2	HTML and CSS	04

- Media tags
- Background and text effects using CSS
- 2D and 3D transformations in CSS
- Display properties: inline, block, flex, grid, table
- CSS Media queries

3 Extensible Markup Language 08

- Introduction to XML
- XML Namespaces
- Document Type Definition (DTD)
- XML Schemas
- Transforming XML into XSLT

4 Client side scripting 14

- Introduction to client-side scripting
- Syntax and Functions of client-side scripting
- Decision making statements
- Loops
- Document object model
- Validation
- Error handling
- DOM
- JSON: JSON syntax, sending receiving and storing data

5 Server side scripting 16

- Introduction to server side scripting languages
- Input/Output Statements
- Decision Statements
- Looping Statements
- Functions/Subroutines
- Server side validations
- Database Connectivity
- CRUD (Create, Update, Read and Update) operations
- Report Generation
- Session and cookies

6 Introduction to frameworks 06

- Overview, MVC architecture

7 Web hosting and security 08

- Types of Hosting: Windows and Linux
- Domain
- Name Servers
- Principles of web security
- Cryptography
- Digital certificates
- Digital signatures
- Secure Socket Layer

Pedagogy

- Course delivery pattern, evaluation scheme, prerequisite shall be discussed at the beginning.
- Lectures preferably to be conducted with the aid of multi-media projector, black board, group activities, charts, cases
- One internal written exam would be conducted as a part of internal theory evaluation.
- One assignment based on the course content may be given to the students to evaluate how learning of objectives is achieved.

Textbooks/ Reference Books

Textbooks:

1) Paul Deitel, Internet and world wide web- How to Program , Pearson Education, 5th Edition
2) Elliotte Rusty Harold and W. Scott Means , XML In A Nutshell, OReilly, 3rd Edition
3) Luke Welling, Laura Thomson , PHP and MySQL Web Development, Pearson Education,5th Edition
4) Bryan Sullivan and Vincent Lui, Web Application Security, A Beginner's Guide, McGraw-Hill Education

Learning Outcomes

On completion of this course the students will be able to :

LO1: Design user friendly websites using HTML and CSS.

LO2: Create dynamic web pages using client side scripting language

LO3: Explain the fundamentals of designing and developing websites and web applications along with the security aspects governing the internet.

Goa University

Programme: B.C.A.

Course Code: CAC117 **Title of the Course: Information Systems**

Number of Credits: 04 **Effective from AY:** 2021-22

Prerequisites None

Objectives

CO1 To provide awareness and appreciation of MIS and to understand the need of MIS in organisations

CO2 To develop an in-depth understanding of essential components comprising Management Information Systems

CO3 To understand the role of MIS in effective decision making

	Content	No. of Hours (60)
1	**Introduction to MIS** • Definition of MIS • Importance of MIS in organizations • MIS as a tool for implementation of management process	04
2	**Data and Information** Definition of data and Information and their sources • Distinction between data and information • Types of Information • Attributes of Information	04
3	**Knowledge** • Definition of knowledge • Differentiate between data, information and knowledge • Types of knowledge • The spiral of knowledge creation • Tools for knowledge conversion • Knowledge and Knowledge Management Systems	08
4	**Decision Making** • Decision making - concept and characteristics • Models of Decision Making • Tools for Decision Making	04
5	**Types of Information Systems** • Office Automation Systems- features, advantages and limitations • Expert System (ES) – features, advantages and limitations • Executive Support System (ESS) – features, advantages and limitations	12
6	**Information Systems in Organizations** Overview of following Information Systems: o ERP Systems o SCM Systems o CRM Systems	12

7 Technology of Information Systems 08

- Data Processing
- Transaction Processing
- Application Processing
- Information System Processing
- OLAP for analyzing information

8 Data Warehouse 08

- Concept of Data warehouse
- Difference between Database and Data warehouse
- Need of Data warehouse for MIS
- Architecture of Data warehouse
- Query and Reporting tools namely, Data Analysis, OLAP and Data Mining

Pedagogy

- Course delivery pattern, evaluation scheme, prerequisite shall be discussed at the beginning.
- Lectures preferably to be conducted with the aid of multi-media projector, black board, group activities, charts, cases
- One internal written exam would be conducted as a part of internal theory evaluation.
- One assignment based on the course content may be given to the students to evaluate how learning of objectives was achieved.
- One case study on MIS needs to be done.

Textbooks/ Reference Books

Textbooks:

1. Waman. S. Jawadekar, Management Information Systems, Tata McGraw-Hill Publishing Company Limited; 5th edition
2. Kenneth J Laudon, Jane P. Laudon Management Information Systems, Pearson; 15th edition
3. Ralph Stair, George Reynolds, Principles of Information Systems, Cengage Learning; 13th edition
4. James A. O' Brien, Introduction to Information System, McGraw-Hill/Irwin; 12th edition
5. S. Sadagopan, Management Information Systems, Prentice-Hall of India Pvt.Ltd.; 2nd Edition
6. Effy Oz, Management Information Systems, Course Technology; Cengage, 3rd edition
7. Lynda AppleGate, Robert Austin & Deborah Soule, Corporate Information Strategy and Management, McGraw-Hill Education; 8th edition

Learning Outcomes

On completion of the course student will be able :

LO1 To understand the role of Information Systems in organizational Management

LO2 To know the various types of organizational information, their origins and how to assess information quality

LO3 To explain what knowledge is; its classifications; to study how knowledge is created; the concept of knowledge management and the importance of capturing, storing and utilizing knowledge in an organization

LO4 To understand characteristics of decision making, decision making models and tools

LO5 To explain the concept of Office automation systems, Expert System and Executive Expert System

LO6 To compare different information systems such as ERP, SCM and CRM systems; to learn the basics of each of these information systems

LO7 To compare the various types of information processing and the use of OLAP for analytical querying

LO8 To explain the need for data warehouse and its importance for decision makers

LO9 To explain real world Information Systems

Goa University

Programme: B.C.A.

Course Code: CAC119 **Title of the Course:** Web Technology Laboratory

Number of Credits: 02(P) **Effective from AY:** 2021-22

Prerequisites

- Basic understanding of using internet and web browser.
- Knowledge of programming

Objectives

CO1. To be familiar with client server architecture.

CO2. To understand developing a websites using modern technologies.

CO3.To gain the skills and project-based experience needed for entry into web application and development careers.

	Content	No. of Hours (60)
1	**Introduction to Web Technology** Introduction to different types of web browsers, text editors, world wide web, Protocols (TCP, IP, UDP, HTTP, HTTPS, FTP, TFTP, SMTP, MIME)	04
2	**Client-side Scripting**	12

Introduction, basic operators, input/output statements, decision statements, looping statements, functions, DOM (document object model), form validation, mouse and keyboard events, AJAX

3	**Extensible Markup Language**	04

XML Structure, XML with Data Source Object, Document Type Definition, Schemas, Namespaces, Transformation Style Sheet, Parsers, Documents and Database

4	**Client-side web framework**	12

Downloading and installing framework, understanding responsive web, grid system, Row and Container Classes, Navbar, Carousel, tables, forms, images, Glyphicons

5	**Server-side Scripting**	12

Introduction, input/output Statements, decision statements, looping statements, functions, database connectivity, CRUD (Create, Update, Read and Delete) operations, session and cookies

6	**Server-side web framework**	12

Downloading and installing framework, Introduction, modules, libraries, APIs, web services, security

7	**Web hosting and Security**	04

Types of Hosting: Windows and Linux, Registering domains, Defining Name Servers, Using Control Panel, Using FTP Client

Web Security: Principles of Security, Cryptography, Digital Certificates, Digital Signatures, Secure Socket Layer

Pedagogy

- Course delivery pattern, evaluation scheme, prerequisite shall be discussed at the beginning.
- Practical sessions to be conducted using any appropriate/suitable tool/software, activity board, group activities, charts, cases, etc.
- One internal written exam would be conducted as a part of internal evaluation.
- One assignment in the form of mini-project may be given to the students to evaluate how learning of objectives was practically achieved. It incorporates designing of problems, analysis of solutions submitted by the students groups.
- A softcopy of e-journal shall be maintained clearly mentioning the name of the experiment and other required information. It is to be submitted in the non-editable *.pdf* format at the end of the semester for evaluation.
- For the purpose of work record, repository (git or any other) may be encouraged to be used by the students.
- Suggestive frameworks for client-side scripting: Bootstrap, Zurb Foundation.
- Suggestive frameworks for server-side scripting: Laravel, Code Igniter, Xamarin.
- FTP Tool: FileZilla, cyberduck
- Control Panels: Plesk, CPanel
- Web server: Xampp, Wamp

Textbooks/ Reference Books	**Textbooks:** 1. Jonathan Fielding, Beginning Responsive Web Design with HTML5 and CSS3; Apress. 2. Marjin Haverbeke, Eloquent JavaScript: A Modern Introduction to Programming, No Starch Press , 3rd Edition. 3. Elliotte Rusty Harold, W. Scott Means, XML In A Nutshell, O'Reilly, 3rd Edition. 4. Luke Welling, Laura Thomson , PHP and MySQL Web Development, Pearson Education,5th Edition 5. Bryan Sullivan and Vincent Lui, Web Application Security, A Beginner's Guide, McGraw-Hill Education **Recommended References:** 1. Paul Deitel, Internet and world wide web- How to Program , Pearson Education, 5th Edition
Learning Outcomes	On completion of the course student will be able to: **LO1**: Train in all aspects of web designing and web development **LO2**: Create visually appealing websites **LO3**: Host responsive and dynamic websites.

Goa University

Programme: B.C.A.

Course Code: CAC120 **Title of the Course:** Multimedia Technology

Number of Credits: 02 (Practical) **Effective from AY:** 2021-22

Prerequisites None

Objectives **CO1** : To learn the design concepts of computer multimedia and its applications

	Content	**No. of Hours (60)**
1	**Introduction to Multimedia** • Multimedia – Types , Applications • Multimedia Design Principles	**08**

- Multimedia Technologies - Image(Graphic), Sound(Audio), Motion Picture(Video)

2 Graphic Media **16**

- Definition, Types, Colour Modes (RGB, CMYK, Grayscale)
- Common Graphic Formats: (What it is, purpose, characteristics, advantages and disadvantage, when to use and when not use)
  BMP, JPEG, PNG, GIF, TIFF, PSD, PDF, EPS, AI, RAW (CR2, NEF)
- Compression Techniques: Definition, types, advantages, disadvantages, and use.
- Graphic manipulation effects
- Introduction to 3D (concept of creating, editing, and analyzing 3D models)

3 Audio Media **14**

- Basic understanding of audio/sound media
- Principles of Audio Recording
- Analogue to digital, and digital to analogue conversion
- Common audio Formats and Codecs: (What it is, purpose, characteristics, advantages and disadvantage, when to use and when not use)
  - Uncompressed: PCM, WAV, AIFF
  - Lossy: MP3, AAC, WMA lossy
  - Lossless: FLAC, ALAC, WMA lossless
- Audio Streaming & Podcasting
- Audio effects & editing platforms

4 Video Media **16**

- Basic concepts of video media
- Common Video Formats and Codec: (What it is, purpose, characteristics, advantages and disadvantage, when to use and when not use)
  - Video Codec H.264, MPEG-4, DivX, MPEG-2, HEVC (H.265)
  - Video Containers: MP4, AVI, MOV, FLV, WMV, Matroska, VOB, AVCHD
- Principles of Video Production- Making, Pre Production (concept , outline, Script, storyboard) and Post Production (Visual effects, Distribution , editing , Colour Correction))
- Recording and broadcasting
- Video Editing

5 Other Media **06**

- Web culture and Media
- Print Media

Pedagogy

- Course delivery pattern, evaluation scheme, prerequisite shall be discussed at the beginning.
- Lectures preferably to be conducted with the aid of multi-media projector, black board, group activities, demonstrations etc.
- One internal written exam would be conducted as a part of internal theory evaluation.
- One assignment in the form of mini-project may be given to the students to evaluate learning

Textbooks/ Reference Books

Text Books

1. Tay Vaughan, Multimedia: Making It Work, , 7th Edition, Tata Mc-Graw Hill., 2008
2. John F.Koegel Buford, Multimedia Systems, Pearson edition, 2003

References

1. Vasuki Belavadi, Video Production, Oxford University Press India; Second edition
2. Ted Alspach, Jennifer Alspach, Illustrator CS Bible, 1st edition, John Wiley & Sons
3. Mediacollege.com
4. Ranjan Parekh, Principles of Multimedia, TMH, 2006.
5. Ralf Steinmetz and Klara Nahrstedt, Multimedia: Computing,Communication and applications, Pearson Edition, 2001
6. Adobe Creative Team, Adobe Audition CS6 Classroom in a Book, Adobe

Learning Outcomes

After course the students are able :

LO1 : To study the different aspects of multimedia

LO2 :To know the issues and principles in design and use of multimedia

LO3 : To learn the different forms of multimedia.

LO4 : To study the concepts of graphic media and colour modes

LO5 :To study the concept of creating, editing, and analyzing 3D models

LO6 : To study the different file formats of graphic media, with focus on its storage and representation

Goa University

Programme: B.C.A.

Course Code: CAC121 **Title of the Course:** E-Commerce Applications

Number of Credits: 04 **Effective from AY:** 2021-22

Prerequisites None

Objectives **CO1.** To develop an understanding of Web-based Commerce

CO2. To equip students to assess e-commerce requirements of a business

CO3. To enable students to develop e-business plans and e-commerce applications

	Content	No. of Hours (60)
1	**Introduction to Electronic Commerce** Meaning, Nature and scope of e-commerce, History of e-commerce, Business applications of e-commerce, E-Commerce Models: - (B2B, B2C, C2C, B2G), Advantages and Disadvantages of e-commerce, Applications of M-Commerce	**06**
2	**E-Commerce Web-sites** Web sites as market place, Role of web site in B2C e-commerce, Web site design principles, Alternative methods of customer communication such as e-mail, E-mail etiquette and e-mail security	**06**
3	**Online Marketing** Online marketing and advertising, Push and pull approaches, Web counters, Web advertisements, Content marketing, Need of Digital Marketing for an e-commerce Business, Search Engine Optimization (SEO), Search Engine Marketing (SEM), Social Media Marketing (SMM), Web Analytics	**10**
4	**Applications of E-commerce** Applications of e-commerce to Supply chain management Applications of e-commerce to Customer Relationship Management, Product and service digitization, Remote servicing	**06**
5	**Business to Consumer E-Commerce Applications** Cataloguing, Order planning and order generation, Cost estimation and pricing, Order receipt and accounting, Order selection and prioritization, Order scheduling, Order fulfilling, Order delivery, Order billing, Post sales service	**06**
6	**Business to Business E-Commerce** Need and Models of B2B e-commerce, Using public and private computer networks for B2B trading; EDI and paperless trading, Characteristic features of EDI service arrangement, EDI architecture and standards, Reasons for slow acceptability of EDI , Value Added Networks	**10**
7	**Electronic Payment System**	**06**

Types of payment systems, credit cards, debit cards, mobile wallets, Electronic Fund Transfer (EFT), Operational credit and legal risk of e-payment, Risk management options for e-payment systems

8 Security Issues in E-Commerce **10**

Risks of e-commerce, Types and sources of threats to e-commerce ; Protecting electronic commerce assets and intellectual property, Firewalls, Client server network security, Security Protocols – SSL, SET, S-HTTP, Data and message security, Security tools, Digital identity and electronic signature, Encryption and concept of public and private key infrastructure; Risk management approach to e-commerce security

Pedagogy

- Course delivery pattern, evaluation scheme, prerequisite shall be discussed at the beginning.
- Lectures preferably to be conducted with the aid of multi-media projector, black board, group activities, charts, cases, etc.
- One internal written exam would be conducted as a part of internal theory evaluation.
- One assignment based on the course content may be given to the students to evaluate how learning of objectives was achieved.

Textbooks/ Reference Books :

Reference Books

1. Agarwala, Kales N., Amity All Deeksha Agarwala,
2. Business on the Net: An Introduction to the Whats and Hows of E-Commerce, Macmillan India Ltd, 2000
3. Diwan, Prag and Sunil Sharma, Electronic Commerce- A Manager's Guide to EBusiness, V anity B ooks International, Delhi.
4. Fitzerald, Business Data Communication Network, McGraw Hill, 1998.
5. Kalakota, Ravi and Andrew B. Whinson, Frontiers of Electronic Commerce, Addison Wesley, 1999.
6. Dishek J. Mankad, Understanding Digital Marketing: Strategies for online success, 2019

Learning Outcomes

On completion of the course student will

LO1. Know the basics of e-commerce

LO2. Know the design principles of websites from the commerce perspective; and use of e-mail in e-commerce

LO3. Explain the different aspects of Online Marketing.

LO4. Explain the different business models of e-commerce and the characteristics and features of each model; understand the different elements of the supply chain; the concept of product and services digitization; understand the working of the online market and CRM

LO5 . Explain the B2C Model of e-commerce

LO6. Explain the B2B model with emphasis on communication techniques between organizations; EDI with focus on reducing delays and costs of communication; concept of a value added network

LO7. Know the different electronic payment systems; the risk management system of e-payments and the Secure Electronic Transaction System
LO8. Explain the security issues, security mechanism and threats to ecommerce;

the risk management of e-commerce systems

Goa University

Programme: B.C.A.

Course Code: CAC122 **Title of the Course:** Multimedia Technology Laboratory
Number of Credits: 02 (Practical) **Effective from AY:** 2021-22

Prerequisites None

Objectives **CO1: Create** and edit graphics, audio streams and video streams.

CO2: **Develop** animated graphics.

	Content	**No. of Hours (60)**
1	Graphic Media Graphic Packages	16
2	**Audio Media** Audio recording and Editing	12
3	**Video Media** A)Video Capturing and Editing B) Video Effects and transitions	16
4	**Animation** A) 2D, 3D Animation Techniques B) Online Animation Tools	16

Pedagogy

- Course delivery pattern, evaluation scheme, prerequisite shall be discussed at the beginning.
- Practical sessions to be conducted using any appropriate/suitable tool/software, activity board, group activities, charts, cases, etc.
- One internal written exam would be conducted as a part of internal evaluation.
- One assignment in the form of mini-project may be given to the students to evaluate how learning of objectives was practically achieved. It incorporates designing of problems, analysis of solutions submitted by the students groups.

- A softcopy of e-journal shall be maintained clearly mentioning the name of the experiment and other required information. It is to be submitted in the non-editable *.pdf* format at the end of the semester for evaluation.
- For the purpose of work record, repository (git or any other) may be encouraged to be used by the students.

Textbooks/ Reference Books

Recommended Text Books:

1. Ranjan Parekh , Principles of Multimedia, Tata McGraw Hill Education Private Limited
2. Brie Gyncild, Adobe Photoshop CS6,Pearson Education

Recommended Reference Books:

1. Adobe Creative Team, Adobe Audition CS6 Classroom in a Book, Adobe
2. Ted Alspach, Illustrator 10 Bible, John Wiley & Sons
3. Robert Reinhardt, Macromedia Flash 8 Bible, John Wiley & Sons

Web References:

www.mediacollege.com

Learning Outcomes

On completion of the course student will be able to :

LO1: Apply various image editing features on images

LO2: Create and edit audio streams

LO3: Capture videos and apply different editing effects on videos

LO4: Create 2D, 3D animations

Goa University

Programme: B.C.A.

Course Code: CAD101 **Title of the Course:** Cyber Security

Number of Credits: 04 (3T+1P) **Effective from AY:** 2021-22

Prerequisites

- Knowledge of basic Networking and programming.

Objectives

In this course learners will get to know:-

CO5. The concepts and the technical skills needed to secure Information.
CO6. Different vulnerabilities of applications and for corrective measures and protection.
CO7. The concepts, tools and techniques for enforcement of Security Policies.
CO8. Different types of Cryptography and Computer Forensics.

	Content	**No. of Hours (75)**
	Theory	**45**
1	Digital Securities Introduction	**09**
	Introductory concepts: Types of Attacks, Digital Privacy, Online Tracking, Privacy Laws, Types of Computer Security risks (Malware, Hacking, Pharming, Phishing, Ransomware, Adware and Spyware, Trojan, Virus, Worms, WIFI Eavesdropping, Scareware, Distributed Denial-Of-Service Attack, Rootkits, Juice Jacking)	
	Data Security: Antivirus and Other Security solution, Password, Secure online browsing, Email Security, Social Engineering, Secure WIFI settings, Track yourself online, Cloud storage security, IOT security, Physical Security Threads	
2	**Online Anonymity**	**06**
	The Android Software Stack, Android Runtime - ART, Android Runtime – Core Libraries, Java Interoperability Libraries, Android Libraries, Application Framework, Restful and Non Restful APIs	
3	**Cryptography and Secure Communication**	**10**
	Cryptography : The Difference Between Encryption and Cryptography, Cryptographic Functions, Cryptographic Types, Digital Signature, The Difference Between Digital Signatures and Electronic Signatures, Cryptographic Systems Trust Models, Create a Cryptographic Key Pair Using Gpg4win/gpg4usb, Disk Encryption Using Windows BitLocker, Disk Encryption Using Open Source Tools, Multitask Encryption Tools, Attacking Cryptographic Systems,	
	Countermeasures Against Cryptography Attacks,	
	Secure Communication : Securing Data in Transit, Cloud Storage Encryption, Encrypt DNS Traffic and Email communication, Secure IM and video calls	
4	**Cyber Crime Issues and Investigation**	**10**
	Cyber Crime : Unauthorized Access, Computer Intrusions, White collar Crimes, Viruses and Malicious Code, Internet Hacking and Cracking, Virus Attacks, Pornography, Software Piracy, Intellectual Property, Mail Bombs, Exploitation, Stalking and Obscenity in Internet, Digital laws and legislation, Law Enforcement Roles and Responses,	

Investigation : Investigation Tools, eDiscovery, EDRM Model, Digital Evidence Collection, Evidence Preservation, E-Mail Investigation, E-Mail Tracking, IP Tracking, E-Mail Recovery, Hands on Case Studies, Search and Seizure of Computers, Recovering Deleted Evidences, Password Cracking

5 Digital Forensics **10**

Introduction to Digital Forensics, Forensic Software and Hardware, Analysis and Advanced Tools, Forensic Technology and Practices, Forensic Ballistics and Photography, Face, Iris and Fingerprint Recognition, Audio Video Analysis, Windows System Forensics, Linux System Forensics, WIFI Security (War-driving), Network Forensics, Mobile Forensics, Cloud Forensics.

Practical **30**

Suggested List of Practical :

1) Implementation to gather information from any PC's connected to the LAN using whois, port scanners, network scanning, Angry IP scanners etc.

2) Implementation of Symmetric and Asymmetric cryptography(eg Gpg4win/gpg4usb) .

3) Implementation of MITM- attack using wireshark/ network sniffers

4) Implementation of Windows security using firewall and other tools

5) Implementation to identify web vulnerabilities, using OWASP project

6) To study working of Intrusion detection System (IDS) tool

7) Disk Encryption Using Windows BitLocker, Disk Encryption Using Open Source Tools

8) Implementation of IT Audit, malware analysis and Vulnerability assessment.

9) Implementation of Cyber Forensics tools for Disk Imaging, Data acquisition, Data extraction and Data Analysis , Recovering deleted files.

Pedagogy

- Course delivery pattern, evaluation scheme, prerequisite shall be discussed at the beginning.
- Lectures preferably to be conducted with the aid of multi-media projector, black board, group activities, charts, cases, etc.
- One internal written exam would be conducted as a part of internal theory evaluation.

- Flipped classroom and case study discussions .
- Guest lecture by visit from the local cyber security law enforcement official

Textbooks/ Text Books

Reference Books

1. Nihad Hassan, Rami Hijazi,Digital Privacy and Security Using Windows: A Practical Guide - Apress
2. Digital Forensics, DSCI - Nasscom, 2012
3. Cyber Crime Investigation, DSCI - Nasscom, 2013.

Learning Outcomes

On completion of the course learners will be able to

LO5. Identify security risks and take preventive steps.
LO6. Investigate cybercrime and collect evidences
LO7. Use knowledge of forensic tools and software

Goa University

Programme: B.C.A.

Course Code: CAD102 **Title of the Course:** Virtualization

Number of Credits: 04 (3T+1P) **Effective from AY:** 2021-22

Prerequisites

- Basic knowledge of Operating System, Computing Resources (CPU, Memory, Storage, & Network), and how programs use resources.

Objectives

In this course learners will be able:-

CO1. To understand the basic concepts of computer virtualization.
CO2. To understand concepts of Hypervisors and Virtual Machines.
CO3. To know to create Virtual Machine and install Operating Systems.
CO4. To understand managing resources of VM (CPU, Memory, Storage, Networking)
CO5. To know to copy a Virtual Machine.
CO6. To understand importance of availability in the Virtual Environment.
CO7. To know to deploy applications in a Virtual machines

	Content	No. of Hours (75)
	Theory	**45**
1	**Understanding Virtualization**	**05**
	Describing Virtualization: Microsoft Windows Drives Server Growth, Explaining Moore's Law	

Understanding the Importance of Virtualization: Examining Today's Trends, Virtualization and Cloud Computing

Understanding Virtualization Software Operation: Virtualizing Servers, Virtualizing Desktops, Virtualizing Applications

2 Understanding Hypervisors 07

Describing a Hypervisor: History of Hypervisors, Type 1 & Type 2 Hypervisors

Role of a Hypervisor: Holodecks and Traffic Cops, Resource Allocation

Comparing Today's Hypervisors: VMware ESX, Citrix Xen, Microsoft Hyper-V

3 Understanding Virtual Machines 06

Describing a Virtual Machine: Examining CPU, Memory, Network Resources and Storage in a Virtual Machine

Understanding How a Virtual Machine Works

Working with Virtual Machines

Understanding Virtual Machine Clones, Templates, Snapshots, & OVF

4 Creating a Virtual Machine 04

Performing P2V Conversions: Investigating the Physical-to-Virtual Process, Hot and Cold Cloning
*Loading Your Environment: Exploring VMware Player
*Building a New Virtual Machine: VM Configuration, Creating a First VM

5 Managing CPUs for a Virtual Machine 05

Understanding CPU Virtualization

*Configuring VM CPU Options

*Tuning Practices for VM CPUs: Choosing Multiple vCPUs vs. a Single vCPU, Hyper-Threading, Working with Intel and AMD Servers

6 Managing Memory for a Virtual Machine 08

Understanding Memory

*Configuring VM Memory Options

*Tuning Practices for VM Memory: Calculating Memory Overhead, and Memory Optimizations

Understanding Storage Virtualization

Understanding iscsi, nfs, datastore, and San

*Configuring VM Storage Options

*Tuning Practices for VM Storage

7	**Managing Networking for a Virtual Machine**	**05**

Understanding Network Virtualization

*Configuring VM Network Options

*Tuning Practices for Virtual Networks

Managing Additional Devices: Using Virtual Machine Tools, Understanding Virtual Devices

8	**Understanding Availability in a Virtual Machine**	**05**

Increasing Availability, Protecting a Virtual Machine, Protecting Multiple Virtual Machines, Protecting Datacenters

Understanding Applications in a Virtual Machine

Examining Virtual Infrastructure Performance Capabilities

Deploying Applications in a Virtual Environment

Understanding Virtual Appliances and vApps

Practical **30**

Suggested List of Practical :

1. Explore VM Player and Create a new Virtual Machine
2. Loading Windows into a Virtual Machine
   - Installing Windows & VMware Tools
   - Understanding Configuration Options
   - Optimizing a New Virtual Machine
3. Loading Linux into a Virtual Machine
   - Installing Linux & VMware Tools
   - Understanding Configuration Options
   - Optimizing a New Linux Virtual Machine
4. Managing CPUs for a Virtual Machine
   - Configuring VM CPU Options
   - Choosing Multiple & Single vCPUs
   - Hyper-Threading

5. Managing Memory for a Virtual Machine
   - Configuring VM Memory Options
6. Copying a Virtual Machine
   - VM Cloning, Working with Templates
   - Saving a Virtual Machine State - Creating and Merging Snapshots
7. Managing Storage for a Virtual Machine
   - Configuring VM Storage Options
   - Tuning Practices for VM Storage
8. Managing Networking for a Virtual Machine
   - Configuring VM Network Options
   - Tuning Practices for Virtual Networks
9. Managing Additional Devices in Virtual Machines
   - Using Virtual Machine Tools
   - Configuring a CD/DVD Drive, a Sound Card, USB Devices, Configuring Graphic Displays, Configuring Other Devices
10. Hands-on session using VMware Tools
    - Exploring Hands-on Labs (VMware HOL)
    - Exploring VMware Workstation
    - Exploring other software like esxi, vcenter etc …

Pedagogy

- At the start of course, the course delivery pattern, evaluation scheme, prerequisite will be discussed.
- Lectures to be conducted with the aid of multi-media projector, black board, etc.
- One internal written exam will be conducted as a part of internal theory evaluation.
- One assignment based on the course content to be given to the students
- Additional Exercises mentioned in the Text Book indicated at sr. no. (1) or similar may be given to students as assignment to explore.
- The course has lab component as integral part, where students have an opportunity to build an appreciation for the concepts being taught in Theory.
- Content/topics with star mark (*) mostly to be covered as practical component. Reference of Text Book indicated at sr. no. (1) may be taken by instructor.
- Experiments to be performed in the laboratory as suggested in the syllabus.

Textbooks/ Reference Books

Text Books

1. Matthew Portnoy, Virtualization Essentials, Sybex, 2012 edition, ISBN: 9781118240175
2. Chris Wolf and Erick M. Halter, “Virtualization” A press; 1 edition 2005

Reference Books

1. Latifa Boursas (Editor), Mark Carlson (Editor), Wolfgang Hommel (Editor), Michelle Sibilla (Editor), KesWold (Editor), "Systems and Virtualization Management: Standards and New Technologies", October 14, 2008
2. Massimo Cafaro (Editor), Giovanni Aloisio (Editor), "Grids, Clouds and Virtualization" Springer; edition 2011.
3. Edward L. Haletky, "VMware ESX Server in the enterprise". Prentice Hall; 1 edition 29 Dec 2007
4. Gaurav Somani, "Scheduling and Isolation in Virtualization", VDM Verlag Dr.Müller [ISBN: 978-3639295139], Muller Publishers, Germany, Sept. 2010
5. Edward Haletky, "VMware ESX and ESXi in the Enterprise – Planning Deployment of Virtualization Servers" [ISBN: 978-0137058976]., Prentice Hall; 2 edition February 18, 2011

Learning Outcomes

On completion of the course learner will be able to :-

LO1. Understand the concepts of Virtualization, Hypervisors, & Virtual Machines
LO2. Create Virtual Machine and install Operating Systems.
LO3. Manage CPUs, memory, storage, and networking of Virtual Machines
LO4. Create a copy of a virtual machine and configure supporting devices for a virtual machine
LO5. Understand methodology and practices for deploying applications in a virtual environment.

Goa University

Programme: B.C.A.

Course Code: CAD103 **Title of the Course:** Mobile Application Development

Number of Credits: 04 (3T+1P) **Effective from AY:** 2021-22

Prerequisites

- Basic knowledge of Operating System, Object Oriented Java Programming, & XML

Objectives

In this course learners will get :-

CO1. To understand system requirements for mobile applications
CO2. To learn the fundamentals of Android OS
CO3. To learn to debug programs running on mobile devices
CO4. To learn to develop mobile application.
CO5. To learn to deploy the mobile applications in marketplace for distribution

	Content	No. of Hours (75)
	Theory	**45**
1	**Introduction**	**06**

Mobile: Mobile device, Mobile ecosystem, Mobile device categories (mobile phone, feature phone, social phone, smartphones, tablet), Types of Mobile OS, Versions of different mobile OS, benefits of mobile apps. Publishing and delivery of mobile applications – Requirements gathering and validation for mobile applications.

Introduction to Development Technologies: Native, Web-based, Hybrid, Progressive Web, etc ...

Android: Android & its versions, Features, Architecture, Devices in the Market, Android Market.

Obtaining the Required Tools - Android Studio, Android SDK, Creating Android Virtual Devices (AVDs), The Android Developer Community, Launching Your First Android Application

Android Studio: Exploring the IDE, Using Code Completion, Debugging Your Application - Setting Breakpoints, Navigating Paused Code,

Publishing Your Application, Generating a Signed APK

2	Activities, Fragments, & Intents	**07**

Understanding Activities - Applying Styles and Themes to an Activity, Hiding the Activity Title, Displaying a Dialog Window, Displaying a Progress Dialog.

Linking Activities - Using Intents, Returning Results from an Intent, Passing Data Using an Intent Object

Fragments- Adding Fragments Dynamically, Life Cycle of a Fragment, Interactions Between Fragments, Understanding the Intent Object, Using Intent Filters, Displaying Notifications

3	**Android User Interface**	**07**

Components of a Screen- Views and ViewGroups, FrameLayout, LinearLayout (Horizontal) and LinearLayout (Vertical), TableLayout, RelativeLayout, FrameLayout, ScrollView.

Adapting to Display Orientation- Anchoring Views

	Managing Changes to Screen Orientation - Persisting State Information During Changes in Configuration, Detecting Orientation Changes, Controlling the Orientation of the Activity	
	Utilizing the Action Bar - Adding Action Items to the Action Bar	
	Creating the User Interface Programmatically, Listening for UI Notifications	
4	**Designing User Interface With Views**	**07**
	Basic Views - TextView View, Button, ImageButton, EditText, CheckBox, ToggleButton, RadioButton, and RadioGroup Views, ProgressBar View, AutoCompleteTextView View **Picker Views** - TimePicker View, DatePicker View **List Views to Display Long Lists** - ListView View, Spinner View **Specialized Fragments** - ListFragment, DialogFragment, PreferenceFragment	
5	**Displaying Pictures & Menus With Views**	**04**
	Image Views to Display Pictures - ImageView View, ImageSwitcher, GridView	
	Menus with Views - Helper Methods, Options Menu, Context Menu, **WebView**	
6	**Data Persistence**	**05**
	Saving & Loading User Preferences - Accessing Preferences Using an Activity, Programmatically Retrieving & Modifying the Preference Values	
	Persisting Data to Files - Saving to Internal Storage, External Storage (SD Card), Choosing the Best Storage Option	
	Creating and Using Databases - Creating the DBAdapter Helper Class, Using the Database Programmatically	
7	**Content Providers**	**04**
	Sharing Data in Android	
	Using a Content Provider -Predefined Query String Constants, Projections, Filtering, Sorting	
	Creating Own Content Providers - Using the Content Provider	
8	**Messaging & Location-Based Services**	**05**
	SMS Messaging - Sending SMS Programmatically, Sending SMS Messages Using Intent, Receiving SMS Messages, Caveats and Warnings	
	Sending Email	

Displaying Maps- Creating the Project, Obtaining the Maps API Key, Displaying the Map, Displaying the Zoom Control, Changing Views, Navigating to a Specific Location, Getting the Location That Was Touched, Geocoding and Reverse Geocoding

Getting Location Data, **Monitoring a Location**

Practical **30**

Suggested List Practical

1. Install and explore Android studio.
2. Create "First Android Application", to display 'Goa University –BCA' in the middle of the screen in the Blue color with White background.
3. Create sample application with Check username and password only. On successful login, go to the next screen and on failing login, alert user using Toast. Also pass username to next screen.
4. Create login application where you will have to validate EmailID (UserName). Till the username and password is not validated, login button should remain disabled.
5. Create and Login application as above. On successful login, open browser with any URL.
6. Creating an Application that displays message based on the screen orientation.
7. Create an application that will change color of the screen, based on selected options from the menu.
8. Create an application that will display toast (Message) on specific interval of Time.
9. Create an UI such that, one screen have list of all the types of Books. On selecting of any book name, next screen should show Book details like: Book name, Author Name, Publication name, images (using gallery) if available, show different colors in which it is available.
10. Using content providers and permissions, Read phonebook contacts using content providers and display in list.
11. Read Messages from the Mobile Devices and Display it on the screen.
12. Create an application to make Insert, Update, Delete and Retrieve operation on the database.
13. Create an application to send message & email
14. Create an application to pick up any image from the native application gallery and display it on the screen.
15. Display Map based on the Current/given location.
16. Learn to deploy android Applications.

Pedagogy

- At the start of course, the course delivery pattern, evaluation scheme, prerequisite will be discussed.
- Lectures to be conducted with the aid of multi-media projector, black board, etc.
- One internal written exam will be conducted as a part of internal theory evaluation.

- One assignment based on the course content for each unit will be given to the student and evaluated at regular interval.
- The course has lab component as integral part, where students have an opportunity to build an appreciation for the concepts being taught in Theory.
- Experiments to be performed in the laboratory as suggested in the syllabus.

Textbooks/ Text Books

Reference Books

1. Jerome DiMarzio, Beginning Android Programming with Android Studio, Wiley; Fourth edition
2. Reto Meier, Professional Android™ 4 Application Development, Wiley

Reference Books

1. Wei-Meng Le, Beginning Android Application Development, Wrox, 1st Edition
2. Lauren Darcey and Shane Conder, Android Wireless Application Development, Pearson Education, 2nd Edition.
3. Carmen Delessio, Lauren Darcey, & Shane Conder, Android Application Development in 24 Hours, Sams Teach Yourself, Sams Publishing, 3rd Edition
4. Dawn Griffiths & David Griffiths, Head First Android Development: A Brain-Friendly Guide, O'Reilly Media, 2nd Edition
5. Rick Boyer, Android 9 Development Cookbook: Over 100 recipes and solutions to solve the most common problems faced by Android developers, Packt Publishing, 3rd Edition
6. Paul Deitel, Harvey Deitel, & Alexander Wald; Android 6 for Programmers: An App-Driven Approach, Pearson Education, 3rd Edition

Learning Outcomes On completion of the course learners will be able to:-

LO1. Describe the requirements for mobile applications
LO2. Demonstrate their understanding and usability skills of the Android OS
LO3. Develop software with reasonable complexity on mobile platform.
LO4. Demonstrate their ability to deploy software to mobile devices

Goa University

Programme: B.C.A.

Course Code: CAD104 **Title of the Course:** Computer Animation

Number of Credits: 04 (3T+1P) **Effective from AY:** 2021-22

Prerequisites

- Basic concepts of animation and video editing software.

Objectives In this course learners will get to :-

CO1. Familiarize with various approaches, methods and techniques of Animation Technology.
CO2. Study the basics of color theory and graphics.
CO3. Master traditional & digital tools to produce stills and moving images.
CO4. Develop expertise in life-drawing and related techniques.
CO5. Apply laws of human motion and psychology in 2-D characters.
CO6. Apply Audio and Video Production Techniques to an Animation Project.

	Content	**No. of Hours (75)**
	Theory	**45**
1	**Introduction to Animation**	04
	History of Computer Animation, Introduction to Animation, Terms used in Animation Types of Animation- Cel (Celluloid) Animation, 2D Animation, 3D Animation, Motion Graphics, Stop Motion. Animation Techniques- Hand-drawn animation, Cut-out animation, Model animation or Stop motion animation, Computer animation or computer generated imagery. Equipment required for animation- Pen tablet, Graphic tablet, Artist glove, Ergo stand, Flex arm.	
2	**Principles of Animation**	04
	Disney's twelve basic principles of animation- Squash and stretch, Anticipation, Staging, Straight ahead action and pose to pose, Follow through and overlapping action, Slow in and slow out, Arc, Secondary action, Timing, Exaggeration, Solid drawing, Appeal	
3	**Fundamentals of drawing and design**	05
	Basic Drawing techniques, Concepts of Visualization- Perspective drawing, Illustration and Sketching techniques, Basic Shapes and Sketching Techniques, Modelling digital objects that one can find reference for in the real world, Modelling hard surface, Developing Animation Character, shading objects and techniques.	
4	**Color Theory and Graphics**	04
	Color fundamentals- primary colors, secondary colors, Tertiary Colors, Color balance, Properties of color-Hue, Reflective Value, Tints and Shades, Saturation, Color tone – Intensity	

Color swatches, Color Charts, Safety Colors & Industrial Identification - Additive Color System (RGB) - Subtractive Color System (CMYK).

Vector and Raster graphics - Overlapping shapes, Reshaping lines and shape outlines - Snapping (object snapping, pixel snapping, snap alignment),Working with color, strokes and fills.

5 Introduction to Digital Imaging 06

Basics of Graphic Design and use of Digital technology

Definition and creation of Digital images, Applying colors to digital images, Digital imaging in animation, Drawing concept.

Introduction to Digital Composition, Use of Design Elements in Digital Layouts, Scanning / Capturing Images, Image editing, Masking and Colour adjustments

6 2D Animation tools processing 08

2D animation software paradigms-Scripting & Storyboarding, Usage of tools for Digital Painting and vector drawings, How to develop a character and background creation, Usage of timeline and its purpose, Creation of symbols, Onion skinning.

7 Basics of 2D Animation 08

Introduction to 2D Animation, 2D motion graphics, Incorporating images into 2D animation, Incorporating sound into 2D animation

Exporting your work to various formats-Still image, GIF, Video, Flash.

8 Motion Data Processing 06

History of motion capture, recording actions of human actors, and using that information to animate digital character models in 2D computer animation

Practical 30

Suggested List of Practical :

1. **Flip Book**
   Drawing simple flip book with minimum 10 pages
2. **Frame by frame animation**
   Creating simple frame by frame animation for a short animation (maximum 20 sec with color drawings and background.
3. **Tween**
   Creating simple animation with shape, classic & motion tweening.
4. **Ball animation**
   Drawing the ball with gradient color, Creating key frames for the animation sequence, Creating stretch and squash for the ball animation, Giving tween to the sequence of ball animation.
5. **Character drawing**

Drawing simple character with pen tool or shape tool, Preparing the character for animation, dividing each body parts into symbol and creating motion

6. **Human/ Animal walk cycle**
   Drawing cycle sheet for an animal walk cycle, Creating four different types of walk cycle (jump, run, tip toe, crawl)
7. **Mini project**

Creating a short animation film

Pedagogy

- Course delivery pattern, evaluation scheme, prerequisite shall be discussed at the beginning.
- Lectures preferably to be conducted with the aid of multi-media projector, black board, group activities, cases, etc.
- One internal written/practical exam would be conducted as a part of internal theory evaluation.
- One assignment based on the course content may be given to the students to evaluate how learning of objectives was achieved.
- The course has a separate laboratory, where students have an opportunity to build an appreciation for the concepts being taught in this course.
- Mini-Project may be given as part of assessment
- Suggestive software's for 2d animation: pencil 2d, adobe flash/animate, synfig

Textbooks/

Text Books

Reference Books

7. Mary Murphy, Beginner's Guide to Animation: Everything you need to know to get started, Watson-Guptill
8. Chris Patmore, The Complete Animation course, Barons Educational Series (New York)

Reference Books

1. Stephen cavalier, The world history of animation, Disney animation, Disney editions 1, 9 Sep 2011.
2. Richard Williams,The Animator's Survival Kit : A Manual of Methods, Principles and Formulas for Classical, Computer, Games, Stop Motion and Internet Animators. Expanded Edition
3. Alberto Menache,Understanding Motion Capture for Computer Animation, The Morgan Kaufmann Series in Computer Graphics Second Edition

Learning Outcomes

On completion of the course learners will be able to:-

LO1. Define terminologies and aspects of computer animations
LO2. Use different tools and techniques of animating graphics
LO3. Implement the concepts of colors, shapes and digital imagery,

LO4. Design and develop 2D and 3D animations using different tools.

Goa University

Programme: B.C.A.

Course Code: CAD105 **Title of the Course:** Computer Graphics

Number of Credits: 04 (3T+1P) **Effective from AY:** 2021-22

Prerequisites

- Basic knowledge of C programming
- Basic data structure.
- Concept of Mathematics. (Geometry, Matrix and other field).

Objectives

In this course learners will get:-

CO1 To study the terminologies, types and forms of computer graphics.

CO2 To know algorithms for rendering and shapes and polygons.

CO3 To Understand the principles of 2D and 3D graphics.

CO4 To Understand the principles of 3D computer graphics

	Content	No. of Hours (75)
	Theory	**45**
1	**Basics of Computer Graphics**	**05**
	1.1 Display devices, graphical Input Devices, Output Devices	
	1.2 Raster scan display, Random scan display	
	1.3 Text mode and graphics mode, graphics functions, Shapes, colors, Co-ordinate systems	
	1.4 Applications of computer graphics	
2	**Line, circle, and polygon**	**10**
	2.1 Basic concepts about points and lines	
	2.2 Line drawing algorithms: Direct Method ,Simple DDA algorithm, Bresenham's Line Drawing Algorithm	
	2.3 Direct/Polynomial circle drawing algorithm, Bresenham's circle drawing algorithm, midpoint circle drawing algorithm	

2.4 Polygons – Types of polygons, Polygon representation, inside –outside test

2.5 Polygon filling: scan-line polygon fill algorithm, Flood fill algorithm, Boundary Fil algorithm

3 2D Concepts **10**

3.1 2D transformation: Translation, rotation, mirror Reflection, scaling, shearing, transformation matrices, homogeneous co-ordinate system

3.2 Composite transformations, transformation between coordinate systems

3.3 2D viewing: The viewing pipeline, viewing coordinate reference frame, window to viewport coordinate transformation, viewing functions

3.4 Line clipping: Cohen-Sutherland Line clipping algorithm, midpoint subdivision algorithm

3.5 Polygon clipping: Sutherland — Hodgeman Polygon clipping algorithm.

4 3D Concepts **10**

4.1 Dimensional Display Methods, Different Parallel projection, Perspective Projection.

4.2 3D object representations: Polygon surfaces , polygon tables,plane equations, polygon meshes.

4.3 3D transformation: translation rotation, scaling, rotation, coordinate axis, reflections, shears

4.4 3D viewing: The viewing pipeline, transformation from world to viewing coordinates projections

5 Curves & Surfaces **05**

5.1 Shape description requirements , parametric functions

5.2 Surface Topology and Curvature

5.3 Spline representations

5.4 Bezier curves and Bezier surfaces.

6 Graphic Systems **05**

6.1 User Interface Designs: Components of User interface – The User's model – The Command Language – Styles of Command Language – Information Display – Feedback – Examples

6.2 Computer Animation: Design of animation sequences, General computer animation functions, raster animations.

Practical **30**

List of Suggested Practical

1. To study the various graphics commands in C language.
2. Develop the DDA Line drawing algorithm using C language
3. Develop the Bresenham's Line drawing algorithm using C language
4. Develop the Bresenham's Circle drawing algorithm using C language
5. Develop the C program for to display different types of lines
6. Perform the following 2D Transformation operation Translation , Rotation and Scaling
7. Perform the Line Clipping Algorithm
8. Perform the Polygon clipping algorithm
9. Perform the following tasks using MATLAB commands.

- Read the grayscale and color image.
- Display images on the computer monitor
- Write images in your destination folder.

10. Generate the complement image using MATLAB.
11. Creating animation with Raster data.

Pedagogy

1. Course delivery pattern, evaluation scheme, prerequisite shall be discussed at the beginning.
2. Lectures preferably to be conducted with the aid of multi-media projector, black board, group activities, charts, cases, etc.
3. One internal written exam would be conducted as a part of internal theory evaluation.
4. One assignment based on the course content may be given to the students to evaluate how learning of objectives was achieved.
5. The course has lab component as integral part, where students have an opportunity to build an appreciation for the concepts being taught in Theory.

6. Experiments to be performed in the laboratory as suggested in the syllabus.

Textbooks/ Text Books

Reference Books

1. M. Newman and F.Sproull, Interactive Computer Graphics, McGraw Hill.
2. Plastok and Gordon Kalley, Computer Graphics, McGraw Hill.
3. Computer Graphics Donald Hearn and M. Pauline Baker , Pearson Education

Reference Books

1. Foley Feiner, Computer Graphics, Principles and Practice – Addison Wesley.
2. William Newman and Robert Sproull; Principles of Interactive Graphics; Tata McGraw hill Publishing company Ltd.
3. N. Krishnamurthy; Introduction to Computer Graphics; TMH
4. Steven Harrington; Computer Graphics; Tata McGraw Hill.

Learning Outcomes The learners after undergoing this course will be able to:

LO1 Understand the concepts of computer graphics system.

LO2 Apply the algorithms to draw lines, circles and polygons.

LO3 Apply transformation techniques to scale, rotate and translate the object.

LO4 Select the methods of enlarging visible portion of drawing.

LO5 Develop the logic for drawing the natural objects using different algorithms for curved lines.

Goa University

Programme: B.C.A.

Course Code: CAD106 **Title of the Course:** Human Computer Interaction
Number of Credits: 04 (3T+1P) **Effective from AY:** 2021-22

Prerequisites

Objectives In this course learners will
CO1 Be introduced to the foundations of Human Computer Interaction, design technologies and user interface design and development.
CO2 Learn the foundations of Human Computer Interaction

CO3 Be familiar with the design technologies for individuals and persons with disabilities

CO4 Learn the guidelines for user interface design and development

CO5 Be aware of mobile HCI

	Content	No. of Hours (75)
	Theory	**45**
1	**Foundations of HCI** The Human: I/O channels, Memory, Reasoning and problem solving; The computer: Devices, Memory, processing and networks; Interaction: Models, frameworks, Ergonomics, styles, elements, interactivity, Paradigms	08
2	**Design Rules and Techniques** Interactive Design basics: process, scenarios, navigation, screen design, Iteration and prototyping. Usability engineering, Prototyping in practice, design rationale. Design rules: principles, standards, guidelines, rules. Evaluation Techniques, Universal Design.	**08**
3	**Models and Theories** Cognitive models, Socio-Organizational issues and stake holder requirements; Communication and collaboration models-Hypertext, Multimedia and WWW	**08**
4	**Mobile HCI** Mobile Ecosystem: Platforms, Application frameworks, Types of Mobile Applications: Widgets, Applications, Games; Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.	08
5	**Web Interface Design** Designing Web Interfaces: Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow	08
6	Future Domains, IHCI and Case Studies	05
	Practical	**30**

List of suggested Practical :

1. Paper Prototyping using templates
2. Story boarding
3. Conducting survey interview and summarizing the result
4. Persona- conducting contextual interview and developing persona

5. GUI design- form design, menu design, help, error messages
6. Web UI design- pages, navigation, controls, (Ajax)
7. Report designs
8. Heuristic evaluation

Pedagogy

- At the start of course, the course delivery pattern, evaluation scheme, prerequisite will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, etc.
- One internal written exam will be conducted as a part of internal theory evaluation.
- One assignment based on the course content will be given to the students
- The course's lab component is integral part, where students have an opportunity to build an appreciation for the concepts being taught in Theory.
- Mini-Project may be given as part of assessment

Textbooks/ Reference Books:

Reference Books

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale; Human Computer Interaction; Pearson Education, 2004 (UNIT I,II and III), 3rd Edition.
2. Brian Fling; Mobile Design and Development , OReilly Media Inc., 2009 (UNIT –IV)
3. Bill Scott and Theresa Neil ; Designing Web Interfaces; OReilly, 2009 (UNIT V), First Edition

Learning Outcomes

On completion of the course learners will be able to :

LO1 Develop meaningful user interface
LO2 Assess the importance of user feedback
LO3 Design effective HCI for individuals and persons with disabilities
LO4 Develop storyboard and design prototype
LO6 Design GUI, Web UI and Reports
LO7 Perform Heuristic Evaluation of the design

Goa University

Programme: B.C.A.

Course Code: CAD107 **Title of the Course:** 3D Modelling & Animation
Number of Credits: 04 (3T+1P) **Effective from AY:** 2021-22

Prerequisites

- Basic drawing skill, visual storytelling and concept of moving images should be known.
- Knowledge of basic Computer hardware & software is also necessary.
- Basic Knowledge of 2D Animation.

Objectives

In this course learners will learn :-

CO1. To develop the skill & knowledge in 3D Modelling and Animation
CO2. To understand the concepts of 2D Splines, shapes & compound objects
CO3. To get basic understanding and skill of 3D Modeling, Keyframe Animation, Simulation & Effects, Lighting,& Camera, Texturing and Rendering

	Content	No. of Hours (75)
	Theory	**45**
1	**Computer-based Animation & Getting Started with Max/Maya/Blender**	**06**
	Definition of Computer-based Animation, Basic Types of animation: Real Time, Non-real-time, Definition of Modelling, Creation of 3D objects.	
	Exploring the Max/Maya/Blender Interface, Controlling & Configuring the Viewports, Customizing the Max Interface & Setting Preferences, Working with Files, Importing & Exporting, Selecting Objects & Setting Object Properties, Duplicating Objects, Creating & Editing Standard Primitive & extended Primitives objects, Transforming objects, Pivoting, aligning etc.	
2	**2D Splines & Shapes & compound object**	**04**
	Understanding 2D Splines & shape, Extrude & Bevel 2D object to 3D, Understanding Loft & terrain, Modelling simple objects with splines, Understanding morph, scatter, conform, connect compound objects, blobmesh, Boolean, Proboolean & procutter compound object.	
3	**3D Modelling**	**06**
	Modelling with Polygons, using the graphite, working with XRefs, Building simple scenes, Building complex scenes with XRefs, using assets tracking, deforming surfaces & using the mesh modifiers, modelling with patches & NURBS	
4	**Key frame Animation**	**06**

Creating Keyframes, Auto Keyframes, Move & Scale Keyframe on the timeline, Animating with constraints & simple controllers, animation Modifiers & complex controllers, function curves in the track view, motion mixer etc.

5 Simulation & Effects **06**

Bind to Space Warp object, Gravity, wind, displace force object, deflectors, FFD space warp, wave, ripple, bomb, Creating particle system through parray, understanding particle flow user interface, how to particle flow works, hair & fur modifier, cloth & garment maker modifiers etc.

6 Lighting& Camera **06**

Configuring & Aiming Cameras, camera motion blur, camera depth of field, camera tracking, using basic lights & lighting Techniques, working with advanced lighting, Light Tracing, Radiosity, video post, mental ray lighting etc.

7 Texturing with Max/Maya/Blender **06**

Using the material editor & the material explorer, creating & applying standard materials, adding material details with maps, creating compound materials & material modifiers, unwrapping UVs & mapping texture, using atmospheric & render effects etc.

8 Rendering with V-Ray **05**

V-ray light setup, V-ray rendering settings, HDRI Illumination, Fine-tuning shadows, Final render setting etc.

Practical **30**

List of suggested Practical :

1).Introduction to 3D Software

- Exploring the Max Interface
- Creating & Editing Standard Primitive Objects
- Creating & Editing Extended Primitive Objects
- Working with Files, Importing & Exporting

2). 2D Splines, Shapes & Compound Objects.

- Understanding 2D Splines & Shape
- Convert 2D to 3D object using extrude, bevel, loft, terrain et
- Using Morph, Scatter, conform, connect compound objects.
- Using Boolean, Proboolean & Procutter

3). 3D Modelling

- Modelling with polygon objects
- Building Simple & Complex Scene
- Using Mesh Modifier
- Modelling with patches & NURBS

4). Keyframe Animation

- Creating keyframes & Auto Key/Set Key
- Animating with simple controllers
- Animation with complex controllers
- Function curves in track view
- Motion mixer

5). Simulation & Effects

- Bind to space warp objects
- Using Gravity & Wind
- Using FFD, wave, ripple, bomb
- Using Particle System
- Using Particle Flow
- Using Hair & Fur Modifier
- Cloth & Garment Maker

6). Lighting & Camera

- Configuring & Aiming Cameras
- Using Camera Motion Blur & Depth of Field
- Using Basic lights
- Using Light tracing, radiosity
- Video Post
- Mental Ray Lighting

7). Texturing with Max

- Using Material Editor
- Create &Apply standard material
- Material Modifier
- Unwrapping UVs

- Mapping texture
- Using atmospheric & render effects

8). Rendering with V-Ray

- Introduction to Scene
- Preparing the Scene
- Basic Settings for Texturing
- Create & Assign Textures
- Light Setup
- V-Ray Rendering Settings
- Fine-Tuning

Pedagogy

- At the start of course, the course delivery pattern, evaluation scheme, prerequisite will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, etc.
- One internal written exam will be conducted as a part of internal theory evaluation.
- One assignment based on the course content will be given to the students
- The course's lab component is integral part, where students have an opportunity to build an appreciation for the concepts being taught in Theory.
- Mini-Project may be given as part of assessment
- **Recommended Software:**
  - Discreet's 3DS Max: an industry standard software package used to create 3D imaging and animation for multi-media, interactive-media, broadcast production, commercial television, and film.
  - Maya and Blender are other software that can be used.

Textbooks/ Reference Books:

Reference Books

1. Michael E. Mortenson, 3D Modeling, Animation, and Rendering, Createspace Independent Pub, 2010
2. Ted Boardman, 3dsmax5 Fundamentals, Techmedia
3. Lance Flavell, Beginning Blender: Open Source 3D Modeling, Animation, and Game Design, Apress
4. Michael G., 3D Modeling and Animation, Igi Publishing
5. Michele Bousquet, Model, Rig, Animate with 3ds Max6, Many world productions
6. Boris Kulagin, 3ds Max8 from Modeling to Animation, BPB
7. Ted Boardman, 3dsmax7 Fundamentals, New Riders

Ted Boardman, Inside3dsmax7, New Riders

Learning Outcomes

On completion of the course, learners will be able to

LO1. Have a good grasp of design as it applies to their forms and animation.
LO2. Identify good and bad composition & staging.
LO3. Identify and build an emotional impact using color, light, and camera perspective within a scene.
LO4. Create and use technical drawings to build models.
LO5. Create surfaces and lighting set-ups that strengthen the overall project design.
LO6. Create strong, narrative illustrations and animation with 3D.

Goa University

Programme: B.C.A.

Course Code: CAD108 **Title of the Course:** Ethical Hacking

Number of Credits: 04 (3T+1P) **Effective from AY:** 2021-22

Prerequisites Basic Knowledge of web application, Database and SQL is essential, Hands of experience of Linux OS.

Objectives

In this course learners will get :-

CO1. To learn the concepts and the technical skills needed detecting and defending threat to web Application.
CO2. To learn about web authentication and bypassing the authentication.
CO3. To learn the concepts; tools and techniques for perform various Input Injection Attacks.
CO4. To understand and apply Penetration Testing to web application

	Content	No. of Hours (75)
	Theory	**45**
1	**Hacking Web Apps and Profiling.** **Web Application Hacking:** GUI web Hacking, URI Hacking, Methods Headers and Body, Resources. The Web Client and HTML, Other Protocols, How & Why Web Apps attack. **Infrastructure Profiling:** Foot printing and Scanning, Basic Banner Grabbing, Advanced HTTP Fingerprinting, Infrastructure Intermediaries.	**09**

Application Profiling: Manual Inspection, Search Tools for Profiling, Automated Web Crawling, General Countermeasures.

2	**Bypassing and Attacking Web Authentication**	**08**

Web Authentication Threats: Username/password Threats, Password Guessing and its Countermeasures, Eavesdropping attacks and its Countermeasures, Forms-based Authentication attacks and its countermeasures. Stronger web Authentication, Web Authentication Services.

Bypassing Authentication: Token Replay, Cross-site Request Forgery, Identity Management

3	Penetration Testing and Input Injection Attacks.	**10**

Penetration Testing :Where to find Attack vectors, Common Input Injection Attacks: Buffer Overflow, Canonicalization and its countermeasures, Advanced Directory Traversal, Navigating Without Directory Listing, HTML Injection: XSS,Embedded scripts, Cookies and Predefined Headers, Counter countermeasures.

SQL Injection: SUB Queries, UNION, Sql Injection countermeasures, XPATH Injection and its countermeasures.

4	**Metasploit Basics of Penetration Testing**	**10**

Metasploit : The Phase of PTES, Types of Penetration Tests. Metasploit: Introduction, Metasploit Basics: Terminology, Metasploit Interfaces, Metasploit Utilities. Intelligence Gathering: Passive Information Gathering, Active Information Gathering, Target Scanning. Vulnerability Scanning: Basic Vulnerability Scan, Scanning with scanning tools, Using Scan Results for Autopwning.

5	**Attacking Users**	**08**

Defacing Content, Capturing User Input: Using Focus Event, Using Keyboard Events, Using Mouse and Pointer Events, Using Form Events, Social Engineering: Using TabNabbing, Abusing UI Expectations: Using Fake Login Prompts, Pretty Theft, Gmail Phishing.

Practical **30**

List of suggested Practical :

1). Perform network scan to revile active hosts, open ports and services running

2) To learn about hacking tools and skills ,study about Footprinting, Fingerprinting

3) Perform privilege escalation attack on Client operating system and gain control of a Client operating system and write a short note on its mitigation strategy

4) Demonstrate ARP Poisoning and detect ARP Poisoning in switch-based network

5) Crack FTP credentials using dictionary attack and write a report of possible suggestion on hardening the login services

6) Perform user system surveillance and write a mitigation report on the same

7) Exploiting NetBIOS vulnerability and password revelation from browsers and social

networking application using Key Logger and Trojan

8). Perform denial service attack on a server operating system and write a report on the same with mitigation strategy .

9) SQL Injection through the use of Wireshark.

10) Introduction of Metasploit ; Penetration Tests and other utilities.

Pedagogy

- Course delivery pattern, evaluation scheme, prerequisite shall be discussed at the beginning.
- Lectures preferably to be conducted with the aid of multi-media projector, black board, group activities, charts, cases, etc.
- One internal written exam would be conducted as a part of internal theory evaluation.
- One assignment based on the course content may be given to the students to evaluate how learning of objectives was achieved. It incorporates designing of problems, analysis of solutions submitted by the students groups.
  The course has a separate laboratory, where students have an opportunity to build an appreciation for the concepts being taught in this course.

Textbooks/ Reference Books

Text Books:

1) Joel Scambray, Vincent Liu, Caleb Sima, Hacking Exposed Web Application, 3rd Edition

2) Dafydd Stuttard and Marcus Pinto ,The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws Wiley Publication.

3) Wade Alcorn, Christian Frichot and Michele Orru ,The Browser Hacker’s Handbook – Wiley Publication.

Reference Books:

1) David Kennedy , Jim O'gorman , Devon Kearns and Mati Aharoni, Metasploit - The Penetration Tester's Guide– NoStarch Press Publication.

2) Joseph Muniz, Aamir Lakhan, Web Penetration Testing with Kali Linux– Packt Publication

Learning Outcomes

On completion of the course student will be able to:-

LO1. know the various threats to a web application.
LO2. to perform various input injection attack simulations.
LO3. provide countermeasures against various input injection attacks.
LO4. have understanding of Metasploit and Web Penetration Testing

Goa University

Programme: B.C.A.

Course Code: CAD109 **Title of the Course:** Internet of Things

Number of Credits: 04 (3T+1P) **Effective from AY:** 2021-22

Prerequisites Basic Programming Knowledge

Objectives

In this course learners will get :-

CO1. To learn and understand the concept of Internet of Things (IOT).
CO2. To study the constituent components of Internet of Things.
CO3. To design and develop IoT applications using different, Sensors/actuators.
CO4. To seek working knowledge of Arduino, Raspberry pi Boards and to develop cloud based IOT projects
CO5. To use tool/techniques to convert IoT projects to IoT product

	Content	No. of Hours
		(75)
	Theory	**45**
1	**Introduction to Internet of Things (IoT) and Sensors**	**08**

Introduction of IoT , IoT Applications, Physical design of IoT, Logical design of IoT.Baseline technologies-M2M,WoT, IOT categories- industrial and consumer, IOT components.

Sensors and Actuators: sensors, transducers, sensor features, resolution, analog sensors, digital sensors, scalar sensors, vector sensors, sensor types. Actuators-

types-hydraulic, pneumatic, electrical, thermal/mechanical ,motors-DC, Servo, Stepper, relays, motor drivers for interfacing

2	I**OT Platforms Design Methodology**	**05**
	Introduction to various steps involved in IOT systems design methodology	
3	**IOT Boards**	**10**
	Arduino : Introduction, Arduino Pinout, Types, Programming Arduino using online and offline IDEs	
	Raspberry Pi : Introduction, Raspberry Pi Pinout, Types, Programming RaspberryPi using Python.	
4	**Cloud Technology :** Introduction to cloud computing definition, characteristics, components , service models-IaaS, Pass, SaaS, Deployment models ,Cloud for IoT, Amazon Web Services for IoT.	**12**
	Visual programming tool for wiring IoT : NodeRed, Introduction, Features	
	Wireless sensor networks : definition, limitations; Sensor cloud-definition, Actors in sensor cloud, architecture	
	Fog computing : Introduction, use of fog computing, architecture of fog, fog nodes, working of fog, applications of fog	
5	**IoT Case Study**	**10**
	Domain Specific IoT's: Home Automation - Smart Lighting, Smart Appliances,Home Intrusion Detection; Cities - Smart Parking; Environment - Weather Monitoring Systems, Weather Monitoring , Air Pollution Monitoring; Agriculture - Smart Irrigation.	
	Practical	**30**

List of suggested Practical :

1. Familiarization with Arduino/Raspberry Pi board and perform necessary software installation.
2. Familiarization of Connectivity and configuration of Arduino/Raspberry Pi board with basic peripherals, LED's and Understanding GPIO .
3. To interface LED with Arduino/Raspberry Pi and write a program to blink LED .

4. To interface Push button/Digital sensor with Arduino/Raspberry Pi and write a program to turn ON LED when push button is pressed or at sensor detection.
5. To interface LCD with Arduino/Raspberry Pi and write a program to display a message .
6. To interface DHT11/ DHT22 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings.
7. To interface motor using relay with Arduino/Raspberry Pi and write a program to turn ON motor when push button is pressed.
8. To interface IR sensor with Arduino/Raspberry Pi and write an application to detect obstacle and notify user using LEDs.
9. To interface a camera with Arduino/Raspberry Pi and write an application to capture and store the image.
10. Design an application to control LED using wireless connectivity with Arduino/Raspberry Pi .

Pedagogy

- Course delivery pattern, evaluation scheme, prerequisite shall be discussed at the beginning.
- Lectures preferably to be conducted with the aid of multi-media projector, black board, group activities, charts, cases, etc.
- One internal written exam would be conducted as a part of internal theory evaluation.
- One assignment based on the course content may be given to the students to evaluate how learning of objectives was achieved.
- The course has a separate laboratory, where students gain hands on experience of working with IOT boards and build IoT projects

Textbooks/ Reference Books

Text Books:

1. Vijay Madisetti and Arshdeep Bahga, “Internet of Things (A Hands-on-approach)”, 1 st Edition, VPT, 2014. (ISBN: 978-8173719547)
2. Raj Kamal, “Internet of Things: Architecture and Design Principles”, 1st Edition, McGraw Hill Education, 2017. (ISBN: 978-9352605224)

Reference Books:

1. Mayur Ramgir, “Internet of Things: Architecture, Implementation and Security”, 1st Edition, Pearson India,2018. (ISBN-10: 9353438942)
2. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things”, 1 st Edition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743)

3. Holger Kerl, Andreas Willig, “Protocols and Architectures for Wireless Sensor Network”, John Wiley and Sons, 2005 (ISBN: 978-0-470-09511-9)

Learning Outcomes

On completion of the course student will be able to

LO1 : Understand the concepts of Internet of Things and gain knowledge to design IoT applications

LO2 : Know about various components involved in IoT design methodology.

LO3 : Design an IoT device to work with a Cloud Computing infrastructure.

LO4 : Use IoT protocols for communication.

Goa University

Programme: B.C.A.

Course Code: CAD110 **Title of the Course:** Data Science Concepts

Number of Credits: 04 (3T+1P) **Effective from AY:** 2021-22

Prerequisites None

Objectives

In this course learners will:-

CO1 : Get to study the fundamentals of data analysis and the science behind it.

CO2 : Learn algorithms for performing complex data analysis.

CO3 : Have an analyst's insight into a data set and its underlying structure.

CO4 : Learn to suggest hypotheses about the causes of observed phenomena.

CO5 : Learn to discover interesting patterns, correlations, associations and causal structures in the data found in data repositories.

	Content	No. of Hours
		(75)
	Theory	**45**
1	**Fundamentals of Analytics and Statistics** • Various Data Science Disciplines: Data Science and Business Buzzwords, Difference between Analysis and Analytics, Continuing with BI, ML and AI • Careers in Data Science: Finding the Job - What to Expect and What to Look for. • Descriptive & Inferential Statistics. • Hypothesis Testing.	02
2	**Data Wrangling and Data Analysis** • Practical Implementation of Inferential and Descriptive Statistics	04

- Cleaning Data - Missing Values, Outliers
- Preparing Data for Modeling - Transformations, Derived Variables
- Visualization Methods and Applications
- Case Studies

3	**Feature Selection and Dimensionality Reduction**	04

- Why to do Feature Selection?
- Feature Selection Techniques
- Feature Selection vs Dimensionality Reduction

4	**Introduction to Machine Algorithms**	02

- Overview of Machine learning
- Overview of Statistical learning
- Supervised Versus Unsupervised Machine Learning
- Regression Versus Classification Problems

5	**Regression And Classification Models**	16

- Simple Linear Regression
- Multiple Linear Regression
- Linear Discriminant Analysis
- Logistic Regression
- Naive Bayes
- K-Nearest Neighbours
- Artificial Neural Networks

6	**Tree Based Models**	08

- Basics of Decision tree
- Bagging and Boosting
- Random Forest
- Gradient Boosting Machines

7	**Unsupervised Learning**	05

- Overview of Clustering
- K-means Clustering
- K-medoid

8	**Association**	04

- Overview of Association Rule Mining
- Market Basket Analysis

Practical **30**

Suggested list of practical :

1. Data Wrangling and Data Analysis
2. Feature Selection and Dimensionality Reduction
3. Introduction to Machine Algorithms
4. Regression And Classification Models and Tree Based Models
5. Unsupervised Machine Learning and Association

Pedagogy

- At the start of course, the course delivery pattern, evaluation scheme, prerequisite will be discussed.
- Lectures to be conducted with the aid of multi-media projector, black board, etc.
- One internal written exam will be conducted as a part of internal theory evaluation.
- One assignment based on the course content for each unit will be given to the student and evaluated at regular interval.
- The course has lab component as integral part, where students have an opportunity to build an appreciation for the concepts being taught in Theory.
- Experiments to be performed in the laboratory as suggested in the syllabus.
- Data Science Projects of intermediate level, medium level and advanced level.

Textbooks/ Reference Books

Text Books

1. Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", Third Edition, Morgan Kaufmann, 2011.

Reference Books :

1. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, "Introduction to DataMining", Person Education, 2007.
2. K.P. Soman, Shyam Diwakar and V. Ajay ", Insight into Data mining Theory and Practice", Easter Economy Edition, Prentice Hall of India, 2016.
3. Gupta, " Introduction to Data Mining with Case Studies", Eastern Economy Edition, Prentice Hall of India, 2006.

Learning Outcomes

LO1 : Learners will be able to work on problems or subset of problems which the Industry is currently working upon.

LO2 : To enhance logical thinking and coding to become ready as a Data Scientist

LO3 : To build an intuition which algorithm should be applied to what kind of data

Goa University

Programme: B.C.A.

Course Code: CAD111 **Title of the Course:** Cloud Computing

Number of Credits: 04 (3T+1P) **Effective from AY:** 2021-22

Prerequisites Basics of Computer Network, Operating Systems, and Programming

Objectives In this course learners will get to :-

CO1. Understand the fundamentals of computing paradigms and cloud computing
CO2. Familiarize with the architecture and the types of cloud systems
CO3. Understand the service and deployment models of cloud
CO4. Work on public and private cloud for various services like Iaas, PaaS and Saas.
CO5. Explore the live applications on the public and private clouds.

	Content	No. of Hours (75)
	Theory	**45**
1	**Fundamentals of Operating System and Networking**	**08**
	Understanding of Operating system concepts, Multiprocessor architecture, Process affinity, Memory, Computer Network, IP Addressing, Subnetting and Supernettting, Designing LANs	
2	**Introduction Computing Paradigms and Cloud Computing**	**10**
	Trends in Computing, Fundamentals of Distributed Computing: Shared memory, issues, challenges, Applications, Grid Computing, Utility Computing and Cluster Computing	
	Concept of Cloud computing-Characteristics, Features and Application, Cloud Architecture, Service models, Deployment Models- Public cloud, Private cloud, Hybrid cloud and Community cloud, Key drivers to adopting cloud, Challenges and Issues.	
3	**Infrastructure as a Service**	**15**
	Introduction: IaaS definition, Introduction to virtualization, Different approaches to virtualization, Hypervisors, Machine Image, Virtual Machine (VM), Applications, Issues and Challenges, Resource Virtualization: Server, Storage, and Network. Examples: Amazon EC2.	
4	**Platform as a Service**	**06**
	Introduction: What are PaaS, Characteristics, Service Oriented Architecture (SOA), Applications, Issues and challenges? Cloud Platform and Management: Computation, Storage, Examples: Google App Engine, Microsoft Azure, SalesForce.com	

5	**Software as a Service**	**06**

Introduction to services, web services, APIs, Service management, Implementation of SaaS, Characteristics, Applications and Issues. Introduction, Web services, Web 2.0, Web OS, Examples, How to implement SAAS

Practical **30**

List of suggested Practical

1. Understanding Computer Network fundamentals and Designing LANs
2. Working on tools used in cloud computing online-
   a. Storage
   b. Sharing of data
   c. Manage your calendar, to-do lists (e.g. Office365)
   d. A document editing tool
3. Working with any cloud service to make spreadsheet and notes and collaborate online in real time and chat with other collaborators. (e.g. Google sheet & Teams)
4. Exploring Public Cloud.(e.g. AWS/Azure)
   a. AWS EC2 / Azure Compute
   b. AWS S3 / Azure Storage
   c. AWS VPC / Azure Vnets
   d. AWS Security / Azure Security

Pedagogy

- At the start of course, the course delivery pattern, evaluation scheme, prerequisite will be discussed.
- Lectures to be conducted with the aid of multi-media projector, black board, etc.
- One internal written exam will be conducted as a part of internal theory evaluation.
- One assignment based on the course content will be given to the students
- The course has lab component as integral part, where students have an opportunity to build an appreciation for the concepts being taught in Theory.
- Experiments to be performed in the laboratory as suggested in the syllabus.

Textbooks/ Reference Books

Text Books:

1. Rajkumar Buyya, Christian Vecchiola and S. Thamarai Selvi, “Mastering Cloud Computing” - Foundations and Applications Programming, MK publications, 2013.
2. Fern Halper, “Cloud Computing for Dummies”, Wiley Publishing Inc., 2010

Reference Books:

1. Barrie Sosinsky: "Cloud Computing Bible", Wiley-India, 2010
2. Richard Hill, Laurie Hirsch, Peter Lake, Siavash Moshiri, Guide to Cloud Computing Principles and Practices, Springer, 2013.
3. Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Cloud Computing: Principles and Paradigms, Wiley, 2011.
4. Robert Elsenpeter, Toby J. Velte, Anthony T. Velte, "Cloud Computing : A Practical Approach", 1st Edition, Tata Mcgraw Hill Education, 2011.
5. Nikos Antonopoulos, Lee Gillam, Cloud Computing: Principles, Systems and Applications, Springer, 2012.
6. Ronald L. Krutz, Russell Dean Vines, Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Wiley-India, 2010
7. Tim mather, subra kumara swamy, shahed Latif, Cloud Computing Security and Privacy, O'Reilly publication.

Learning Outcomes

On completion of the course learners will be able to:-

LO1 Understand the fundamentals of computing paradigms and cloud computing

LO2 Understand the cloud architecture and types

LO3 Understand the service and deployment models of cloud

LO4 Work on public and private cloud for various services like Iaas,PaaS and Saas.

LO5 Explore the application on the public and private cloud

Goa University

Programme: B.C.A.

Course Code: CAD112 **Title of the Course:** Content Management Systems

Number of Credits: 04 (3T+1P) **Effective from AY:** 2021-22

Prerequisites Basic understanding of HTML, Web Technology, Computer Networks.

Objectives In this course learners will:-

CO1: get insights in the various CMS platforms available.

CO2: learn to setup a CMS on local/cloud and manage the administrative tasks.

CO3: learn to use platforms like WordPress, Wix, Joomla, Moodle,

CO4 : design websites using the CMS and style them.

CO5: learn to publish the websites on live server and maintain them.

Content **No. of Hours**

(75)

Theory **45**

1 Introduction to Content Management Systems 02

- Traditional Content Delivery Systems
- Need for Content Organization
- Merits /Demerits of CMS
- Planning and Developing Dynamic Web Content Sites

2 Planning and Developing Dynamic Web Content Sites 03

- Setting site goals
- Identifying target audiences
- Wire framing and planning site
- function and flow
- Installing CMS applications
- Working with ISPs to add site features to servers.
- Working with MySQL and backend data structures.
- Building and Administrating a WordPress Blog Site

3 Building and Administrating a WordPress Blog Site 07

- Understanding the differences between Wordpress.com sites and Wordpress.org sites.
- Setting up and installing a Wordpress site.
- Finding and adding templates to a new site
- Customize site features, Overview of administrative functions, Adding extra functionality of Wordpress blogs, Promoting new blog sites.
- Security aspects of wordpress: how to make your wordpress website more secure, plugins available, Backups and restore in wordpress.
- WooCommerce plugin to build ecommerce websites using Wordpress.

4 Building an Online Social Network Using SocialGo 04

- Installing and configuring a new SocialGo based site, Overview of site design and editing features.
- Creating customized look and feel, Promoting new social media sites

5 Building and administration of Prestashop based website 04

- Installing and configuring Prestashop, using a theme and various modules of Prestashop to build fully functional website with admin panel .

6 WebSite Design Using CSS 03

- Overview of CSS value and features.
- Exploration of how to use CSS to redesign text features
- How to use CSS to move and position web graphics

- Create website

7	**Creating and Maintaining a Wikimedia site**	04

- Installing and formatting Media Wiki, Creating and editing separate wiki entries,
- Adding coding functionality and hyperlinks
- Creating and Maintaining a Wikimedia site

8	**To learn to work with Wix**	03

- Setting up a Wix account
- Laying out pages; using template features
- Adding site content features
- Creating interactive links.
- CMS Development using Wix

9	**Creating Online Courses Using Moodle**	07

- Planning and designing online training materials.
- Installing the Moodle LMS platform software.
- Adding media features to online courses.
- Adding quiz and grading options.

10	**Building Websites Using Joomla**	06

- Acquiring a host for Joomla.
- Installing Joomla,
- Exploring the Admin Interface,
- Planning the website.
- Joomla plugins

11	Comparison of Various CMS Tools	02

- Comparative analysis of features of CMS Tools

Practical **30**

Suggested list of Practical :

1). Word press

- Install wordpress
- Create users
- Install and setup theme
- Install plugins
- Customize css
- Develop a Blog Website

- Develop an Ecommerce website using Woocommerce plugin

2). Social Go

- Setup Socialgo account
- Use and explore various features

3). Prestashop

- Setup Prestashop
- Explore various modules
  Develop ecommerce website using free template

4).Wikimedia

- Setup Wikimedia
- Create a wiki with sections , toc and other similar concepts

5).Wix

- Setup wix free account
- Create simple portfolio or similar website

6). Moodle

- Setup Moodle
- Create users, courses, activities and quizzes

7). Joomla

- Setup Joomla
- Develop simple blog website

Pedagogy

- At the start of course, the course delivery pattern, evaluation scheme, prerequisite will be discussed.
- Sessions to be conducted in the class with the aid of multi-media projector, etc.
- One internal exam will be conducted as a part of internal evaluation.
- One assignment in the form of mini-project/ alternative mode will be given to the students.
- Practical ISA also needs to be conducted in lab environment
- Students can be given assignment on tools they study.
- Group discussion may be used during planning phase of website
- Live demos also can be shown
- Latest version can be used or any stable version of software in use

Textbooks/	**Reference Books**
Reference Books	1. Jose A. Tizon, John Horton ,PrestaShop 1.5 Beginner's Guide **Packt Publishing Limited** 2. Andy Williams,WordPress for Beginners 2019: A Visual Step-by-Step Guide to Mastering WordPress, Amazon Digital Services 3. Rahmel Dan , Beginning Joomla, Apress
Learning Outcomes	On completion of this course the learners will be able to : LO 1: Create dynamically manageable CMS LO 2: Configure and use Word Press CMS LO 3: Work with SocailGo CMS LO 4: Design quality CMS sites using CSS LO 5: Configure and maintain a Wiki site, Wix and moodle LO6: Design websites using Joomla

Goa University

Programme: B.C.A.

Course Code: CAD113 **Title of the Course:** Search Engine Optimization

Number of Credits: 04 (3T+1P) **Effective from AY:** 2021-22

Prerequisites	Basics of Web Technology and Communication skills
Objectives	In this course learners will get to know techniques of CO1: directing traffic to a website. CO2: implement Web Analytics, Search Engine Optimization, and Search Engine Marketing. CO3: analyzing data and assessing reports on traffic to web sites; CO4: writing content for page ranking in order to improve website visibility in search engine listings.

	Content	**No. of Hours**
		(75)
	Theory	**45**
1	**Introduction to SEO,SEM and PPC** • White Hat Vs Grey Hat Vs. Black Hat SEO • Good and Bad Practices in SEO (organic and inorganic) • Building your Site for SEO	**04**
2	**SEO and The Search engines** • Working of search engines	**02**

- Role of search engines spiders/Robots
- Designing search engine spiders
- Optimizing Search Strategies

3 Site Architecture and Keyword Selection **05**

- Importance of Keywords,
- Usage of Long Tail keywords
- choosing your keywords,
- usage of multiple keywords,
- strategies to Find niche keywords,
- stop-words,
- Decompiling competitor websites

4 Content Design and Page Optimization **08**

- structure your page content
- Onpage and Offpage Search engine optimization
- Optimizing your website for keywords , website theme, page and file names, Meta tags, page title tags, Meta description tags, Meta keywords, h tags, li tags, p tags, alt tags, title attribute tags
- avoiding the misuse of header tags
- Correcting source code of website
- Mobile Optimization and responsiveness of a site
- Choosing the best writing style
- Create unique content, build infographics,
- Rewriting content in avoiding duplication or plagiarism issues
- avoid Search engine penalization

5 Linking Strategies **04**

- Importance of Links
  - Inbound and Outbound
- PageRank
- Internal links and external links
- Choosing the best sources of links
- Need to link to forum, blogs and social media sites
- link farm

6 Technical Considerations

- CSS vs table-based design
- Understanding website frames
- choosing the best domain name
- choosing the best hosting company
- Validating your website pages

02

7 Decompile a Competitor Website **04**

- Ways to beat the competition
- Using Google Chrome, Firefox, IE, as a research tool
- find your competition
- Find why they have good search engine rankings
- checking the number of cached pages f website
- analyzing their site architecture
- finding the keywords, they use
- find ing who links to them

8	**SEO Tools** • Setup and use a Google Webmaster Account • verify your website • Setup and register a Google sitemap • Produce and install a robots.txt file • Using a 301 redirect. • Types and Usage of various SEO plugins (free/paid)	**04**
9	**Monitoring Traffic** • Configure and deploy Google tag Manager • Setup and use the Google Analytics and its metrics • Bounce rate, time on site, geolocation, heat map, visitors etc.	**04**
10	**Maximizing Conversions** • Website usability • Importance of Website conversions through SEO • Principles in designing the ultimate website With respect to SEO	**02**
11	**SEM** • Introduction to SEM • Link building, blogging, social media • Viral marketing • PPC, PPA campaigns, ad campaigns • Email marketing • Affiliate marketing • Podcasting, • Rich media • managing Ad Campaign, Campaign Targeting • Managing keywords on website and their success., Keyword tools • PPC management and SEO, • Maximizing Pay-per-Click Strategies, • Major ad networks • "Content network" vs search advertising • Writing effective ads • Creating a landing page. • Conversions and calls-to-action. • A/B Testing	**06**
	Practical	**30**

Suggested List of Practical :

1. Assign a website with significant traffic for analysis to Decompile a Competitor Website:
    - How to beat the competition
    - How to use Google Chrome as a research tool
    - How to find your competition
    - How to find why they have good search engine rankings
    - How to check the number of cached pages
    - How to analyse their site architecture
    - How to find the keywords they use
    - How to find who links to them
2. Create a relevant website to host keeping in mind:
    a. CSS vs table based design
    b. Understanding website frames
    c. How to choose the best domain name
    d. How to choose the best hosting company
    e. How to validate your website pages
3. Improve a poorly focused pages of website:
    - Take an existing site/page and begin to optimize it with enhanced content and design.
    - optimize page and file names
    - Choose appropriate website theme
    - structure your page content
    - Correct the code, optimize Meta tags,optimize page title tags,optimize Meta description tags, optimize Meta keywords, optimize h tags, optimize li tags, optimize p tags, optimize alt tags, optimize title attribute tags, avoid the misuse of header tags
    - Assess your site for calls-to-action
    - optimize your keywords
    - Rewrite the content, using longtail keywords
    - integrate social media
    - build Mobile responsive pages
    - Choosing the best writing style
    - Review for duplicate content
    - avoid penalization
4. Reviewing website for duplicate content issues across other sites to avoid penalisation
5. Apply robot controls (produce and install robots.txt file)
6. Use Keyword tools to find relevant and niche keywords and analyze competitors keywords.
7. Create Inbound(backlinks) and Outbound links
    a. Reviewing Page ranks so the best source links are utilized to build rank for your website(websites, forums, blogs,social media)
    b. build link farm
8. Setup Google Webmaster Tools and Yahoo! Site Explorer
9. Use Google Tag Manager to configure and deploy Google Analytics into your website Google.
    - Monitor traffic , sessions and generate report by analyzing the data, concentrating different metrics used.
10. Setup and Register site to Google, Yahoo! And Bing: URL and Sitemaps
11. Learn to use 301 redirects
12. Implement SEM strategies to the website
13. Improve load time of websites: Implement measures for Negative SEO attacks

Pedagogy

- Course delivery pattern, evaluation scheme, prerequisite shall be discussed at the beginning.
- Lectures preferably to be conducted with the aid of multi-media projector, black board, group activities, charts, cases, etc.
- One internal written exam would be conducted as a part of internal theory evaluation.
- One assignment based on the course content may be given to the students to evaluate how learning of objectives was achieved. It can incorporate designing of problems and analysis of solutions submitted by the student's groups. E.g.
    - Give an individual Final semester Project to select/build a site built by student to apply analytics, SEO and SEM strategies.
    - Complete initial SEO of individual project site
    - Write 1-page summary of organic traffic on group site.
    - Discuss effect of designs on organic traffic.
    - Complete landing page Complete tweaks to site to improve your conversion rate
    - Track analytics

Textbooks/ Reference Books

Text Books

1. Peter Kent; Search Engine Optimization for Dummies , Wugnet Publications, 6th Edition.
2. Danny Dover and Erik Dafforn; Search Engine Optimization (SEO) Secrets , Wiley Publication

Learning Outcomes

The student after undergoing this course will be able to:
LO1: Understand the concept of Search Engine Optimization and Search Engine Marketing.
LO2: Know the process of generating keywords relevant to a Web site.
LO3: Create Web pages designed to be easily crawled and optimally indexed by search engines.
LO4: Attract inbound Links from other Web Sites.
LO5: Create Pay-Per-Click Campaigns.
LO6: Use Google Analytics and other metrics / tools to monitor progress in achieving search engine marketing goals.

Goa University

Programme: B.C.A.

Course Code: CAD114 **Title of the Course:** Web Frameworks

Number of Credits: 04 (3T+1P) **Effective from AY:** 2021-22

Prerequisites Basics of Web Technology and Communication skills

Objectives **CO1** : To enable learners develop a complete web application that includes front-end, backend and data-exchange technologies using frameworks.

CO2 : To teach learners implement mvc and responsive design to scale well across pc, tablet and mobile phones.

CO3 : To building strong expertise in document oriented non-relational database management system.

CO4 : To equip learners with the complete knowledge of creating and deploying scalable and web applications.

	Content	No. of Hours (75)
	Theory	**45**
1	**Introduction to Full Stack Web Development**	**02**
	The Rise of Full-stack JavaScript, Node.js, The Node.js Ecosystem, MongoDB, AngularJS	
2	**Node.js**	**04**
	Familiarity with JavaScript, The Problem with I/O, Node.js Server, REPL, Writing the Server, npm, npm install, npm search, package.json, The node_modules Folder, Module Dependencies, require(), Writing a Module, Module Functionality, Caching, npm link.	
3	**Node's Programming Model**	**10**
	The Event Loop, Concurrency, Asynchronous Coding, Callback Functions, Calling Conventions, Exception Handling, Event Emitters, Listening for Events, Exception Handling, Promises, Promise Chaining, Modules, Command Line Arguments, Working with the File System, Reading Files, Writing Files, Streams, Readable Streams, Writable Streams, The Standard Streams, Creating a Server, Routes, Accessing Request Headers, The Node Server Application, Routing, Database Module, Querying the Database, Response Generator.	
4	**MongoDB**	**04**
	NoSQL Databases, History of MongoDB, Installing MongoDB Locally, Cloud Hosting, Heroku Integration, The MongoDB Shell, Inserting New Data, Retrieving Data, Updating Data, Deleting Data, Deleting Collections, Deleting Databases.	
5	**Interacting with MongoDB Using Mongoose**	**03**
	Mongoose Node Module, Schemas, Mongoose Models, Creating More Documents, Simple Queries, Updating.	
6	**Express**	**10**
	The Building Blocks of Express, Router, Middleware, Routes, Generating an Express App, Jade, The Server, app.js, app.use, cookieParser, Static Files, Error Handling, app.set,	

RouterObject, Using the RouterObject, Simulating Database Interaction, Generating the HTML

7 Angular JS **12**

Single-page Applications, SPA Frameworks, Model-View-Controller Architecture, Getting Angular, Building from Source, Releases, Angular "Hello World", One-Way Data Binding, Two-Way Data Binding, $watch, Digest Loop, Simple Controllers, Data Binding with Lists, Angular Directives, Creating Directives, Dependencies, Client-side Routing with ngRoute.

Practical **30**

Suggested List of Practical :

1. Installation and setup of nodejs
2. Web server written in node, a node server with file i/o
3. Node configuration with package.json file
4. Exercises on require(), modules, caching, event loops, async coding, callback functions, exceptions handling, event emitters and promise.
5. Working with files, streams and routes
6. Implementing complete web server in node.
7. Setting mongodb environment.
8. Exercise for crud operations in mongo.
9. Interactions through mongoose.
10. setting up express
11. Exercises on file processing, routing, cookies, database interaction through express.
12. setup of angularjs
13. Exercises for creating webpages, data binding and client side routing

Pedagogy

- Course delivery pattern, evaluation scheme, prerequisite shall be discussed at the beginning.
- Lectures preferably to be conducted with the aid of multi-media projector, black board, lms, miniprojects etc.
- One internal written exam to be conducted as a part of internal theory evaluation.
- One live project based on the course content may be given to the students to evaluate how learning of objectives was achieved.
- The course has a separate laboratory, where students gain hands on experience of working with the various frameworks

Textbooks/ Reference Books

Text Books :

1. Adam Bretz and Colin J. Ihrig, “Full Stack JavaScript Development with MEAN”, 1 st Edition, Sitepoint, 2015. (ISBN: 9780992461256)
2. Holmes, Simon, “Getting MEAN with Mongo, Express, Angular, and Node”, 2nd Edition, Manning Publications, 2015. (ISBN: 978-9352605224)

Reference Books :

1. Ethan Brown, “Web Development with Node and Express: Leveraging the JavaScript Stack”, 1st Edition, Pearson India, 2014.(ISBN-10: 1491949309)
2. Amos Q. Haviv, "MEAN Web Development”, 2nd Edition, Packt Publishing . (ISBN: 9781785886300)

Learning Outcomes

On completion of the course student will be able to

LO1 : Setup up web server using node frameworks

LO2 : Create front end web interfaces using angular js

LO3 : Programme the server using express js

LO4 : Use mongo as backend database support

LO5 : Create and deploy web applications

Annexure V

Semester I & II (additional SECs proposed)			
Course Code	Course Title	Course Credits	AY
CAS-109	E-Accounting Tools	2(P)	2020-21
CAS-110	Information Communication Technology Tools	2(P)	2020-21
CAS-111	Google Tools	2(P)	2020-21
CAS-112	Open Source Technology	2(P)	2020-21
CAS-113	.NET Platforms	2(P)	2020-21
CAS-114	Unix Environment and Scripting	2(P)	2020-21
CAS-115	Data Analysis Tools	2(P)	2020-21

Goa University

Programme: B.C.A.

Course Code: CAS109 **Title of the Course:** E-Accounting Tools

Number of Credits: 02 (Practical) **Effective from AY:** 2020-21

Prerequisites Knowledge of Basic Accounting

Objectives **CO1**. To strengthen the fundamentals of accounting and provide strong foundation for other accounting courses.

CO2. Intensify knowledge on all the basic components by using double entry system.

	Content	**No. of Hours (60)**
1	**Introduction to Company Management** • Creating company • Alteration and Deletion of Company • Groups:Alteration and deletion of Groups • Creation of ledgers ,Suppliers & Customers ledger with bill wise details • Introduction to masters and Account Masters	**08**
2	**Accounting vouchers** • Understanding default accounting voucher types • Receipt voucher, Payment voucher, Contra voucher, Purchase voucher- invoice and voucher mode, Sales voucher- invoice and voucher mode	**12**
3	**Inventory masters** • Inventory Masters- Stock Group, Stock category, Stock Item, Unit and Godown • Creation of inventory masters • Alteration and deletion of inventory masters	**10 08**
4	**Reporting an user management** • MIS Reporting • Exceptional Reports • Email Reports • Confirmation of Accounts • Generate Reminder Letters • Split of Data, Group and Merge Company • Back-up and restore	**12**

5 GST Accounting **1012**

- GST on Goods (Local & Interstate)
- GST on Services (Local & Interstate
- Item rate wise and value wise GST
- HSN and SAC
- ITC under GST and Adjustment thereof
- Analysis of GSTR-1, GSTR-2 and GSTR-3/3B
- Treatment of Reverse charge in GST

6 Important features **08**

- Bank Reconciliation
- Export and Import of data
- Data Security and Backup
- Zero Valued Transactions
- Configurable Invoicing
- Stock Transfer
- Cheque Printing

Pedagogy

1. Course delivery pattern, evaluation scheme, prerequisite shall be discussed at the beginning.
2. Suggested lists of tools to be used for this course: Tally, Busy Accounting Software.
3. Sessions to be conducted in the laboratory with the aid of multi-media projector, etc.
4. One internal practical exam will be conducted as a part of internal evaluation.
5. One assignment in the form of mini-project will be given to the students.
6. Experiments shall be performed in the laboratory as indicated in the syllabus.
7. A softcopy of e-journal shall be maintained clearly mentioning the name of the experiment and other required information.

Textbooks/ Reference Books

Reference Books

1. Asok k. Nadhani, Tally ERP 9 training guide, BPB publications
2. Chheda Rajesh, Learn Tally.ERP 9 with GST and E-Way Bill , Paperback
3. Nadhani Asok K, GST Accounting with Tally.Erp 9 , BPB publications
4. TALLY EDUCATION PRIVATE LIMITED, GST Using Tally.ERP9, Paperback

Websites

1. https://tallysolutions.com/

Learning Outcomes

The student after undergoing this course will be able to:

LO1. Understand finalization of Accounts and other aspects related to E-Accounting.

LO2. Understand the current functioning of GST.

Goa University

Programme: B.C.A.

Course Code: CAS110

Title of the Course: Information Communication Technology Tools

Number of Credits: 02 (Practical) **Effective from AY:** 2020-21

Prerequisites None

Objectives

CO1. Learn knowledge of ICT including new and emerging technologies
CO2. Learn Autonomous and discerning use of ICT
CO3. Learn Skills to enhance work produced in a range of contexts
CO4. Learn Skills to consider the impact of current and new technologies on methods of working in the outside world and on social, economic, ethical and moral issues
CO5. Learn ICT-based solutions to solve problems

	Content	No. of Hours (60)
1	**Concepts of Information and Communication Technology** • Understand what hardware is, know about factors that affect computer performance and know about the peripheral devices. • Understand what software is and give examples of common applications software and operating system software. • Understand what Information and Communication Technology (ICT) is and give examples of its practical applications in everyday life. E.g. Communication applications, Data handling applications, Measurement applications, microprocessors in control applications, Modelling applications, Applications in manufacturing industries, Booking systems, Banking applications, Computers in medicine, Computers in libraries., Expert systems, Computers in the retail industry, Recognition systems, Satellite systems • Understand health and safety and environmental issues in relation to using computers. • Recognise the important security issues associated with using computers. • Recognise the important legal issues in relation to copyright and data protection associated with using computers.	**12**
2	**Office Productivity tools** • Word Processor • Spreadsheet • Presentation Maker	**1816**

- Picture Manager

3 Communication **1012**

- Common Network environments and the effects of using them,
- Communication with other ICT users using email
- Effective use of the internet
- Search Engines
- Blogs
- Collaborative Software

4 ICT for Educational Administration and Management: Learning Management Systems **20**

- Basic Setup : Installation of Wamp Server, Installation of Moodle LMS, managing user accounts, Managing course settings, Logging in, Customizing your profile, Customizing course settings, Editing the header block, Posting a course syllabus & Lecture Slides.
- Working with Resources: Creating a text label, Linking to a web site, Creating a text page, Creating a web page, Linking to folder of documents
- Working with Media: Posting image files, Posting a photo gallery, Posting audio Posting video files
- Adding Activities: Creating Assignments, Creating a forum, Creating a wiki, Creating Quiz
- Administration: User Accounts (Student, Teacher, Course Creator, Administrator) , Editing, Settings

Pedagogy

1. Course delivery pattern, evaluation scheme, prerequisite shall be discussed at the beginning.
2. The subject content details the topics which must be studied. Everything listed must be studied, however, examples are not exhaustive and other related aspects of the topics should be studied.
3. Sessions to be conducted in the laboratory with the aid of multi-media projector, etc.
4. One internal practical exam will be conducted as a part of internal evaluation.
5. One assignment in the form of mini-project will be given to the students.
6. Experiments shall be performed in the laboratory as indicated in the syllabus.
7. A softcopy of e-journal shall be maintained clearly mentioning the name of the experiment and other required information.

Textbooks/ Reference Books

Reference Books

1. Stephen Doyle, Complete ICT for Cambridge IGCSE; OUP Oxford; 2 edition
2. Elaine Marmel Teach Yourself VISUALLY Office 2016; John Wiley & Sons; 1 edition
3. Jaswinder Singh, How to use Moodle 2.7: Teacher's Manual for the world's most popular LMS;

4. Tomei, Lawrence A., Learning Tools and Teaching Approaches through ICT Advancements , Taxmann Publications Private Limited
5. Mitsuru Kodama, Competing Through ICT Capability: Innovation in Image Communication; Edward Elgar Publishing Ltd

Learning Outcomes

The student after undergoing this course will be able to:

LO1. Explore applicability of ICT to today's business organizations and the Competitive marketplace

LO2. Use software tools to place and edit an image to meet the requirements of its intended application and audience.

LO3. Use software tools to prepare a basic document to match the purpose and target audience, to use headers and footers appropriately within a range of software packages, format text and organize page layout, to edit tables and mail merge a document with a data source.

LO4. To apply styles to ensure consistency of presentation, use a master slide to appropriately place objects and set suitable styles to meet the needs of the audience.

LO5. Design and use suitable software tools to create an appropriate database record structure, manipulate data, to adjust the display features in a spreadsheet and to produce reports to display data appropriate to purpose and audience

LO6. Configure and use Learning Management Systems, Blogs, Search engines, Email and other collaborative software.

Goa University

Programme: B.C.A.

Course Code: CAS111 **Title of the Course:** Google Tools

Number of Credits: 02 (Practical) **Effective from AY:** 20-21

Prerequisites Basic understanding of using internet.

Objectives

CO9. To develop an understanding of various google tools available.

CO2. To enable students to use these tools efficiently.

	Content	**No. of Hours (60)**
1	**Introduction to basic Google tools** • Google Chrome browser • Setting up Gmail account and its settings	40

- Google search engine
- Google Translate
- Google news
- Google Fonts
- Google maps
- Google alerts
- Google keep
- Google docs
- Google sheets
- Google slides (Create or import, Add content ,Share and collaborate, Present, print, and download)
- Google Forms (Creating a form or quiz or survey, sharing with multiple people)
- Google Calendar (Schedule events, Create reminders, Share and view calendars, Customize your calendar, Access your notes and tasks)
- Google Chat (Create direct messages and rooms

  Collaborate in Chat, Manage chats)
- Google + (Set up your profile, Post and share content, Follow people, Create communities)
- Google Contacts (Create contacts and contact groups, Email contacts and contact groups, Organize contacts)
- Google Groups (Find and join a group, Post conversations and responses, Create a group, Collaborate with your team in Groups)
- Google Photos (Searching, sharing, managing and backing up photos and videos, editing photos and movies)
- Google Vault (Supported data types, Hold and retention, Vault search and export, Vault administrators)
- Google Earth (Search for places, using voyager, sharing location, Street View)
- GSuite

2 Google Classroom 04

- Features and concept of Google classroom

- Creating and joining classroom
- Adding announcements and lesson materials
- Adding and grading assignments
- Managing students

3 Google Meet 04

- Start and join video meetings
  -(Start a video meet, join a video meet, adding people to a meet)
- Collaborate in video meetings
  -(Customize video meetings, share resources in a video meeting, broadcast video meetings)
- Add-ons for Google meet
  (Google Meet Plus, Nod, Google Meet Push to talk, Google Meet Grid View, Meet attendance, Virtual backgrounds for Google Meet)

4 Google Drive 04

- Setting up drive on your devices
- Storing files in drive
- Finding and viewing files
- Sharing files inside and outside of an organization
- Troubleshooting errors

5 Youtube 04

- YouTube basics
- Branding your channel
- YouTube policies and guidelines

6 Google Analytics 04

- Introduction
- Google Analytics Interface
- Basic Report
- Basic campaign and conversion tracking

Pedagogy

1. Course delivery pattern, evaluation scheme, prerequisite shall be discussed at the beginning.
2. Sessions to be conducted in the laboratory with the aid of multi-media projector, etc.
3. One internal practical exam will be conducted as a part of internal evaluation.

4. One assignment in the form of mini-project will be given to the students.
5. Practical shall be performed in the laboratory as indicated in the syllabus.
6. A softcopy of e-journal shall be maintained clearly mentioning the name of the experiment and other required information.

Textbooks/ Reference Books

Reference Books

1. Alice Keeler, 50 Things You Can Do With Google Classroom, Dave Burgess Consulting, Inc.
2. Daniel Waisberg,Google Analytics Integrations, Wiley (2015)
3. Rob Ciampa, YouTube Channels For Dummies, For Dummies; 1 edition
4. Roberet William, A Beginners Guide to Google Drive And Docs: Step-by-step Practical Instructions to Google Drive, Docs, Sheets and Forms

Learning Outcomes LO1 To learn the basic usage of Google Tools.

Goa University

Programme: B.C.A.

Course Code: CAS112 **Title of the Course:** Open Source Technology

Number of Credits: 02 (Practical) **Effective from AY:** 20-21

Prerequisites None

Objectives To make the students aware of :

CO1. FOSS [Free and Open Source Software,

CO2. Linux installation and management basics,

CO3. Open source software and installation

CO4. Existing open source projects

	Content	**No. of Hours (60)**
1.	**Introduction**	08

Open Source, Free Software, Free Software vs. Open Source software, Public Domain Software, FOSS does not mean no cost.

Social Impact:

Open source vs. Closed source, Open Source ethics. Social and Financial impacts of Open Source technology

2. Four degrees of freedom, FOSS Licenses: GPL, AGPL, LGPL,FDL; FOSS examples. 04

3. Introduction to Linux: How is it built, Distributions, desktops, file system basics, User management and file permissions 12

4. Software installation and updation : GUI, Command line; tips for picking software 08

5. **Case Studies and Contributing to Open Source Projects** 08

Case Studies:

Example Projects: Apache web server, GNU/Linux, Android, Mozilla (Firefox), Wikipedia, Drupal, Wordpress, GCC, GDB, github, Open Office. Study: Understanding the developmental models, licensings, mode of funding, commercial/non-commercial use. Open Source Hardware, Open Source Design, Open source Teaching. Open source media. Collaboration, Community and Communication

Contributing to Open Source Projects: 04

Introduction to GitHub, interacting with the community on GitHub, open source code, reporting issues, contributing code.

6. Introduction to Libre Office, Bluefish, GIMP / Pinta, Stellarium, Audacity, OpenShot Video editor, Camstudio 16

Suggested list of practical:

1. Create a bootable device (USB preferred) using an Linux ISO image and trying the OS from the device
2. Installing Linux on a PC and creating users (GUI)
3. Installing desktops and desktop customization.
4. man, cat, less, grep, who, whoami, ls, ps, sudo, chmod, chown
5. Searching and Installing software using software center, synaptic package manager, command line
6. Assigning file permissions and sharing files to users.
7. Advanced user management (GUI)
8. Libre Office
9. Bluefish

10. Stellarium
11. OpenShot
12. GIMP / Pinta
13. A mini project may be given as an assignment to students as Contributing to Open Source

    Contribute to any Open Source project in any GitHub repositories by doing the following:

    a. Testing
    b. Reporting bugs
    c. Coding
    d. Helping in documentation
    e. Participating in discussions
    f. Participating in pre-release testing programs
    g. UI development.

Pedagogy

1. Course delivery pattern, evaluation scheme, prerequisite shall be discussed at the beginning.
2. Sessions to be conducted in the laboratory with the aid of multi-media projector, etc.
3. One internal practical exam will be conducted as a part of internal evaluation.
4. One assignment in the form of mini-project will be given to the students.
5. Practical's shall be performed in the laboratory as indicated in the syllabus.
6. Practical's can be done using Ubuntu or any Linux OS.
7. A softcopy of e-journal shall be maintained clearly mentioning the name of the experiment and other required information.

Textbooks/ Reference Books

Text books:

1. Unix Concepts and Applications by Sumitabha Das, Tata McGraw Hill Education, 2006
2. The official Ubuntu Book, Prentice Hall; 8th Edition

Reference Books:

1. Daniel James, Crafting Digital Media: Audacity, Blender, Drupal, GIMP, Scribus, and other Open Source Tools ; Apress; 1st ed.

Web References:

1. http://spoken-tutorial.org
2. Open Source Initiative: https://opensource.org/
3. Github: https://help.github.com/
4. http://www.tldp.org/LDP/lame/LAME/linux-admin-made-easy/
5. https://www.gnu.org/philosophy/
6. https://opensourceforu.com/2017/02/linuxsusadmin/
7. https://www.linux.com/learn/understanding-linux-file-permissions

8. https://opensource.org/licenses
9. https://opensource.org/licenses/alphabetical

Learning Outcomes

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

LO1. Design applications using .NET

LO2. Analyze the use of .Net Components depending on the problem statement

LO3. Implement & develop a .Net application with Database connectivity

Goa University

Programme: B.C.A.

Course Code: CAS113 **Title of the Course:** .Net Platforms

Number of Credits: 02 (Practical) **Effective from AY:** 20-21

Prerequisites Introductory Programming Course

Objectives

CO1: Set up a programming environment for .net programs.

CO2: Configure an .net application.

CO3: Creating .Net applications using standard .net controls

CO4: Connecting to data sources and managing them.

Content	**No. of Hours (60)**
1. Introduction • **O**verview of Microsoft .NET Framework - The .NET Framework components- The Common Language Runtime (CLR) Environment- The .NET Framework class Library • Getting Started with Visual Basic .net IDE : Set up of work environment, start page, the menu system, toolbars, the new project dialog box, graphical designers, code designers, the object explorer, the toolbox, the solution explorer, the class	12 08

view window, the properties window, the dynamic help window, the server explorer, the output window, the command window

- Visual basic language concept : variables, Constants, Data Types, Operators, Control Structures and loops - Arrays : single and multidimensional array, declaring, dynamic array.

2. Introduction to Windows Form Controls 12

- Working with Form - Properties : appearance, behaviour, layout, windows style etc, methods and events - Differentiate procedure oriented, object oriented and event driven programming – Input box- Message box- Working with Common Tool Box Controls: Label , button, Textbox , NumericUpDown , Check Box, Radio Button , Group Box , control and all important methods and events.

3. Additional Controls and Menus of Windows 12

- Working with other controls of toolbox: Date Time Picker, List Box, Combo box, Picture Box, Rich Text Box, Progress bar, Masked Text box, Link Label, Checked List box - Working with Menus: creating menu, Inserting, deleting, assigning short cut keys, popup menu.

4. In-built Functions and Dialog Box 12

- Inbuilt Functions : Mathematical Functions
- String manipulation
- Dialog Boxes: OpenFileDialog, SaveFileDialog, FontDialog, ColorDialog, PrintDialog
- Sub Procedures and functions : declaring, passing and returning arguments, exiting from it, pass by value and pass by ref

5. Basic SQLs 0608

- Working with basic SQL commands for insert, delete, update, Selects

6 Database Programming- ADO.NET 06 08

- Introduction to ADO.NET and .net data providers
- Using Connect, Command, DataReader object to access databases
- How to connect to MsAccess
- Using DataSet, DataTable etc.
- Using datasource controls
- Retrieving and manipulating data using GridView, DetailsView, ListView, FormView and DataList

Pedagogy

1. Course delivery pattern, evaluation scheme, prerequisite shall be discussed at the beginning.
2. Sessions to be conducted in the laboratory with the aid of multi-media projector, etc.
3. One internal practical exam will be conducted as a part of internal evaluation.
4. One assignment in the form of mini-project will be given to the students.
5. Experiments shall be performed in the laboratory as indicated in the syllabus.

6. A softcopy of e-journal shall be maintained clearly mentioning the name of the experiment and other required information.

Textbooks/ Reference Books

Textbooks :

1. Shelly, cashman, Quasney ‘ Microsoft Visual Basic .NET : Comprehensive Concepts And Techniques ‘Cengage learning, 2012
2. Steven Holzner , Visual Basic .NET Programming Black Book , Dreamtech Press Publications, New Delhi

Learning Outcomes

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

LO1. Design application using .NET

LO2. Analyze the use of .Net Components depending on the problem statement

LO3. Implement & develop a .Net application with Database connectivity

Goa University

Programme: B.C.A.

Course Code: CAS114 **Title of the Course:** Unix Environment and Scripting

Number of Credits: 02 (Practical) **Effective from AY:** 20-21

Prerequisites Concepts of Operating System , Programming in C

Objectives This course will provide the students with the skills:

CO1: To use the UNIX and LINUX operating system.

CO2: To use basic commands for editing and manipulating files, managing processes and interacting with the Bourne/Bourne Again Shell.

CO3: To use the programming constructs of the shell language to write scripts that may be used to simplify or automate tasks.

CO4: To work on UNIX/LINUX ENVIRONMENT as a technical user or system administrator of a powerful, fast growing, multitasking, open operating system which is currently used on all types of computers from micros to mainframes.

	Content	**No. of Hours (60)**
1.	**Introduction** • Introduction to Operating System , History of GNU , Unix and LINUX , Unix System Layered and Detailed Architecture • History of UNlX & various flavors for Unix / Linux • Installation of Linux/Unix system (basic and advanced configuration) • Logging in to the UNIX system	08

- Familiarization with the GUI & Command line processing
- Logging in & out of the system & Shutting down & rebooting
- Familiarization with User & system applications.

2. UNIX file system 04

- UNIX File System
- UNIX File types
- UNIX Directory structure and special purpose directories(eg. /dev /proc)

3. Unix/ Linux Commands 16

- Basic commands and using command history
- Commands to
    - Navigating the Filesystem: pwd, ls, mkdir,rmdir, lsblk, mount,df
    - move around the ., .. & hidden directories and to move around by path concept,
    - creating new directories,
    - creating files –touch , cat ; copying files; moving files,
    - current working directory, referring to home directories,
    - Deleting files and directories;
    - A look at /proc, /dev /etc /var
    - looking at files : cat, more, pg, less , head , tail; banner, file, wc,comm,ln,cmp, dd, alias,sort, cut, grep ,cmp,, diff, uniq , bc ;
    - Getting online help;
    - manual pages ;
    - Listing commands , meta characters ,Wildcards; hidden files;
    - Standard input and output;
    - redirecting input and output;
    - filter; pipes;
    - file permissions;
    - users and groups;
    - Interpreting file permissions;
    - Permission Dependencies;
    - Changing permissions, Setting Permissions.
    - Managing file links; hard links; symbolic links;
    - Manage Jobs and process: process ID; foreground and background jobs; suspend and interrupt a process; killing jobs; changing password, exit.

4. Unix advanced Commands and Tools 12

- Using Aliases & dynamic aliases
- Unix file operations: basename, ln, find
- Unix system status commands: dmesg, last ,w, who -r ,uname,, lsb_release, hostname
- Privileged Access: su, sudo, visudo
- Advanced process management in Unix:ps -aef ,ptree,kill,nice,renice,pmap,pfiles

- Text Manipulation commands: awk, grep, egrep, sed, tr
- Unix filesystems commands: fstyp, df, du, which, locate, chown, chmod
- Working with disks and filesystems: mount, umount, dd, fsck, growfs, tune2fs, mkfs,quota
- process management: ps, top, htop, kill
- Networking: iifconfig, nslookup, ptables, netstat, traceroute,ping, finger
- Remote Access: telnet, SSH
- Data & File Transfer: ftp,sftp,scp, wget, cURL
- Package Manager: yum,rpm
- File Compression and Archiving : gzip, gunzip, zcat, bzip2, tar
- Printing Usage: lpr, lpq, lprm,
- Understanding server load parameters

5 Editor and Shell Scripting 12

- Command mode, insert mode and last line mode; command to delete character, insert line; deleting text, command for moving the cursor; including other files;
- running shell commands;
- getting vi help; search and replace commands;
- changing and deleting text, Change word, Change line,
- Delete current line, Delete n lines, Delete remainder of Lines; copying and moving;
- Saving and Exiting ;
- Shell as an interpreter; pattern matching; redirection; pipes; command substitution; shell variables, environment variables , Keywords, Assignment Statements, read , echo ,Shell scripts and execution methods, Setting positional parameters (set command), Shift , metacharacters , arithmetic operators,
- logical and relational operators, Test Command: Numerical Test, File Test and String Test; Control Flow through if, case ; Loops ; while, until ,for

6 System Administration 08

- Installing and upgrading UNIX syatem software
- Adding and Removing Users,
- Starting up and Shutting down the System,
- Disk Management,
- File System Mounting and Unmounting,
- creating policies(computer, network, security, backup, recovery)
- Monitoring System Usage and performance(eg. Nagios or cmd monitoring tools) ,
- Ensuring System Security
- Applying patches and upgrades

List of Suggested Practical :

1. Installation of Unix/Linux operating system.
2. Study of logging/logout details.
3. Study of Unix/Linux general purpose utility command list obtained from (man, who,

cat, cd, cp, ps, ls, mv, rm, mkdir, rmdir, echo, more, date, time, kill, history, chmod, chown, finger, pwd, cal, logout, shutdown) commands.

4. Study of vi editor(http://www.tutorialspoint.com/unix/pdf/unix-vi-editor.pdf) or any equivalent.
5. Study of Bash shell, Bourne shell and C shell in Unix/Linux operating system.
6. Study of Unix/Linux file system (tree structure) and permissions.
7. Study of .bashrc, /etc/bashrc and Environment variables.
8. Shell Scripts
   a. Shell script to display list of user currently logged in.
   b. Write a shell script to display "Hello World".
   c. Write a shell script to develop a scientific calculator.
   d. Write a shell Script to check whether the given number is even or odd.
   e. Shell script to search whether element is present is in the list or not
   f. Shell Script to check whether the given string is palindrome or not using command line substitution.
9. Shell scripts and sed
   a. To check whether given file is a directory or not.
   b. To count number of files in a Directory.
   c. To copy contents of one file to another.
   d. Create directory, write contents on that and Copy to a suitable location in your home directory.
   e. Use a pipeline and command substitution to set the length of a line in file to a variable.
   f. Using sed command to print duplicated lines of Input.

10. Shell script programming
    a. Write a shell script to check variable attributes of file and processes.
    b. Write a shell script to check and list attributes of processes.
    c. Shell Script to implement read, write, and execute permissions.
    d. Shell Script for changing process priority.

11. Configure Nagios

Pedagogy

1. Course delivery pattern, evaluation scheme, prerequisite shall be discussed at the beginning.
2. Sessions to be conducted in the laboratory with the aid of multi-media projector, etc.
3. One internal practical exam will be conducted as a part of internal evaluation.
4. One assignment in the form of mini-project may be given to the students.
5. Discussion on real life situations / problems faced on the job and their solutions
6. Task based teaching methodology where students are given tasks to do in class, as required in the real world.
7. A softcopy of e-journal shall be maintained clearly mentioning the name of the experiment and other required information.

Textbooks/ Reference Books

Text Books:

1. Yashwant P.Kanetkar ; UNIX AND SHELL PROGRAMMING , BPB Publication , 2002
2. Richard.L Peterson ; The Complete Reference Linux,Tata Mc Graw Hill, 2003, Fifth Edition

Reference Books :

1. Sumitabha Das ; Unix: Concepts and Application, TMH, Second Edition, 1998
2. Arnold Robbins; Linux Programming by Examples: The Fundamentals, Pearson Education, First Edition, 2004
3. Maurice J. Bach, Design of the Unix operating System ,PHI, First Edition,
4. 1986
5. Stephen G. Kochan and Patrick Wood, Unix Shell Programming, Pearson Education ,3rd edition, 2007
6. David I. Schwartz, Introduction to UNIX , Pearson Education , Second Edition , 2009
7. Ellie Quigley, UNIX SHELLS by Example, Prentice Hall, Fourth Edition, 2008
8. Steve Shah and Wale Soyinka , Linux Administration- A beginners Guide, Tata McGraw Hill, Fourth Edition ,2005

Learning Outcomes

The student after undergoing this course will be able to:

LO1: To customize a UNIX login account using environment variables, configuration files and startup scripts.

LO2: To maintain UNIX directories and files, manage UNIX jobs and processes, use of UNIX pipes and file redirection, manipulate data with proper use of Unix filters, role of an operating system and UNIX philosophy.

LO3: To operate in both graphical and text-based environments; automate a sequence of operations by writing a shell script.

LO4: To apply UNIX security tools to ensure UNIX directories and files are protected from unauthorized users.

Goa University

Programme: B.C.A.

Course Code: CAS115 **Title of the Course:** Data Analysis Tools

Number of Credits: 02 (Practical) **Effective from AY:** 2020-21

Prerequisites Basic knowledge of statistical techniques

Objectives

CO1. Learn Descriptive and Inferential Statistics with the help of simple practical examples

CO2. Learn Statistics using software

CO3. Learn Advance level statistical analysis

CO4. Learn Data analysis for fact based decisions Representation of the findings

	Content	**No. of Hours (60)**
1	Statistics Introduction and Definitions • Introduction • Definitions	02 04
2	Basics of Statistics • GUI • Data types • Qualitative v/s Quantitative data/ Continuous v/s Discrete data • Population and sampling • Mtcars Datasets • Understanding formula and functions • Conversions from one system to another • Relative v/s absolute reference • More functions	06 04
3	Descriptive statistics • Central tendency • Variation • Installing data analysis pack and calculating descriptive statistics • Shapes • Arrays	0604
4	Data visualization • Histograms • Charts • Plots	**08**
5	Probability • Basic concepts • Factorial • Permutations and combinations	**08**
6	Probability distributions • Normal • Binomial • Other distributions related to binomial distribution • Poisson distribution	**08**

7	Hypothesis testing • Sample Z test • P value • Sample t test • Two sample t test • Two sample p test • F and Chi square	**08**
8	ANOVA • Formulae and calculations in ANOVA • Two factor ANOVA	**06 04**
9	Goodness of fit and contingency table • Goodness of fit • Contingency table	**04**
10	Correlation and linear regression • Correlation • Linear regression	**04 08**

Pedagogy

8. Course delivery pattern, evaluation scheme, prerequisite shall be discussed at the beginning.
9. Sessions to be conducted in the laboratory with the aid of multi-media projector, etc.
10. One internal practical exam will be conducted as a part of internal evaluation.
11. One assignment in the form of mini-project will be given to the students.
12. Experiments shall be performed in the laboratory as indicated in the syllabus.
13. A softcopy of e-journal shall be maintained clearly mentioning the name of the experiment and other required information.

Textbooks/ Reference Books

Reference Books

1. Hastie, Trevor, et al. The elements of statistical learning. Vol. 2. No. 1. New York: springer, 2009.
2. Montgomery, Douglas C., and George C. Runger. Applied statistics and probability for engineers. John Wiley &Sons, 2010
3. Richard Cotton, "Learning R", O'Reilly, 2013
4. Dalgaard, Peter, "Introductory statistics with R", Springer Science & Business Media, 2008
5. Brain S. Everitt, "A Handbook of Statistical Analysis Using R", Second Edition,4 LLC, 2014
6. Samir Madhavan, "Mastering Python for Data Science", Packt, 2015
7. Sheldon M. Ross,"Introduction to Probability and Statistics for Engineers and Scientists", 4th edition, Academic Press; 2009.
8. Paul Teetor, "R Cookbook, O'Reilly, 2011.
9. Mark Lutz ,"Learning Python", O'Reilly,5th Edition,2013

Learning Outcomes

The student after undergoing this course will be able to:

LO1. Apply Descriptive and Inferential Statistics
LO2. Solve Statistical problems using software
LO3. Do software-based advance level statistical analysis
LO4. Make fact based decisions based on analysis of given data using software represent the findings using software.