Annexure I

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	

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	

Existing Skill Enhancement Course (SEC)						
Course Code	Course Title	Course Credits	AY	Marks	Sem	Hours
CAS-101	IT Tools Laboratory	2(P)	2019-20	50	I/II	60
CAS-102	Programming in Scratch	2(P)	2019-20	50	I/II	60
CAS-103	Digital Photography	2(P)	2019-20	50	I/II	60
CAS-104	Open Source Software	2(P)	2019-20	50	I/II	60
CAS-105	Operating Systems Laboratory	2(P)	2019-20	50	I/II	60
CAS-106	Programming in Python	2(P)	2019-20	50	I/II	60
CAS-107	HTML & CSS	2(P)	2019-20	50	I/II	60
CAS-108	PHP Programming	2(P)	2019-20	50	I/II	60

Additional Skill Enhancement Course (SEC) Proposed						
Course Code	Course Title	Course Credits	AY	Marks	Sem	Hours
CAS-109	E-Accounting Tools	2(P)	2020-21	50	I/II	60
CAS-110	Information Communication Technology Tools	2(P)	2020-21	50	I/II	60
CAS-111	Google Tools	2(P)	2020-21	50	I/II	60
CAS-112	Open Source Technology	2(P)	2020-21	50	I/II	60
CAS-113	.NET Platforms	2(P)	2020-21	50	I/II	60
CAS-114	Unix Environment and Scripting	2(P)	2020-21	50	I/II	60
CAS-115	Data Analysis Tools	2(P)	2020-21	50	I/II	60

Discipline Specific Elective (DSE) Proposed						
Course Code	Course Title	Sem	Course Credits	AY	Marks	Hours
CAD-101	Cyber Security	V	4(3T+1P)	2021-22	100(75T+25P)	75(45T+30P)
CAD-102	Virtualisation	V	4(3T+1P)	2021-22	100(75T+25P)	75(45T+30P)
CAD-103	Mobile Application Development	V	4(3T+1P)	2021-22	100(75T+25P)	75(45T+30P)
CAD-104	Computer Animation	V	4(3T+1P)	2021-22	100(75T+25P)	75(45T+30P)
CAD-105	Computer Graphics	V	4(3T+1P)	2021-22	100(75T+25P)	75(45T+30P)
CAD-106	Human Computer Interaction	V	4(3T+1P)	2021-22	100(75T+25P)	75(45T+30P)
CAD-107	3D Modelling and Animation	VI	4(3T+1P)	2021-22	100(75T+25P)	75(45T+30P)
CAD-108	Ethical Hacking	VI	4(3T+1P)	2021-22	100(75T+25P)	75(45T+30P)
CAD-109	Internet of Things	VI	4(3T+1P)	2021-22	100(75T+25P)	75(45T+30P)
CAD-110	Data Science Concepts	VI	4(3T+1P)	2021-22	100(75T+25P)	75(45T+30P)
CAD-111	Cloud Computing	VI	4(3T+1P)	2021-22	100(75T+25P)	75(45T+30P)
CAD-112	Content Management Systems	VI	4(3T+1P)	2021-22	100(75T+25P)	75(45T+30P)
CAD-113	Search Engine Optimisation	VI	4(3T+1P)	2021-22	100(75T+25P)	75(45T+30P)
CAD-114	Web Frameworks	VI	4(3T+1P)	2021-22	100(75T+25P)	75(45T+30P)

Existing Generic Elective (GE)						
Course Code	Course Title	Course Credits	AY	Marks	Semester	Hours
CAG-101	Business Accounting	4(T)	2019-20	100	I/II/III/IV	60
CAG-102	Cost Accounting	4(T)	2019-20	100	I/II/III/IV	60
CAG-103	Advertising	4(T)	2019-20	100	I/II/III/IV	60
CAG-104	Human Resource Management	4(T)	2019-20	100	I/II/III/IV	60
CAG-105	Entrepreneurship Development	4(T)	2019-20	100	I/II/III/IV	60

Additional Generic Elective(GE) proposed						
Course Code	**Course Title**	**Course Credits**	**AY**	**Marks**	**Semester**	**Hours**
CAG-107	Critical Thinking & Problem Solving	4(T)	2020-21	100	1/II/III/IV	60
CAG-108	Data Analyses and Statistical Techniques	4(T)	2020-21	100	1/II/III/IV	60
CAG-109	Public Administration	4(T)	2020-21	100	1/II/III/IV	60
CAG-110	Ergonomics	4(T)	2020-21	100	1/II/III/IV	60
CAG-111	Social Engineering	4(T)	2020-21	100	1/II/III/IV	60
CAG-112	E-Waste Management	4(T)	2020-21	100	1/II/III/IV	60
CAG-113	Ethics and CSR	4(T)	2020-21	100	1/II/III/IV	60
CAG-114	Business Infrastructure and Management	4(T)	2020-21	100	1/II/III/IV	60
CAG-115	Information Security	4(T)	2020-21	100	1/II/III/IV	60
CAG-116	Decision Making and Mathematical Models	4(T)	2020-21	100	1/II/III/IV	60
CAG-117	IT in Management	4(T)	2020-21	100	1/II/III/IV	60
CAG-118	Data Mining and Business Intelligence	4(T)	2020-21	100	1/II/III/IV	60
CAG-119	Micro Economics	4(T)	2020-21	100	1/II/III/IV	60
CAG-120	Monetary Economics	4(T)	2020-21	100	1/II/III/IV	60
CAG-121	Digital Marketing Fundamentals	4(T)	2020-21	100	1/II/III/IV	60
CAG-122	Social Media Marketing & Analytics	4(T)	2020-21	100	1/II/III/IV	60
CAG-123	Investment and Portfolio Management	4(T)	2020-21	100	1/II/III/IV	60
CAG-124	General Insurance	4(T)	2020-21	100	1/II/III/IV	60
CAG-125	Green Computing	4(T)	2020-21	100	1/II/III/IV	60
CAG-126	Research Methodology	4(T)	2020-21	100	1/II/III/IV	60

Annexure II

Semester III & IV courses

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
CAA-101	Communication and Presentation Skills	4(T)	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
CAA102	Technical Writing Skills	4(T)	2020-21

Goa University

Programme: B.C.A.

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	In this course learners will get :- **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)**
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 v.Hybrid Inheritance • Method overriding • Virtual base classes • Abstract classes • Interfaces	12
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
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, Programming with Java, Mc Graw Hill, 6th Edition **Reference Books :** 1. Martin Fowler, UML Distilled : A Brief Guide to the Standard Object Modeling Language , Pearson Education, 3rd Edition 2. Herbert Schildt, The Complete reference Java 2; Mc Graw Hill Education, 10th Edition **NPTEL Resources** Programming in Java : https://nptel.ac.in/courses/106/105/106105191/
Learning Outcomes	On completion of the course learners will be able to :- **LO1.** Describe the meaning of Object Oriented paradigms **LO2.** Implement programs using Object Oriented concepts **LO3.** Design basic programs using Object Oriented concepts **LO4.** Demonstrate the conceptual models of UML

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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	This course is aimed at learners :- **CO1.** To understand and learn database concepts **CO2.** To learn and understand the Data Models. **CO3.** To learn DDL and DML (SQL Concepts) **CO4.** To learn and design the database for an enterprise **CO5.** To learn how to organize, maintain & retrieve data effectively & efficiently **CO6.** 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	03
3	**Database Implementation and Technologies** • Database Servers, ODBC • Client/Server Platform • Distributed databases • Data Warehousing and Data Mining	03
4	**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:	20

	entity integrity, referential integrity	
5	**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	16
6	**Transaction processing concepts** • Transaction processing system • Schedule, Recoverability, Serializability, locks • ACID Properties	08
7	**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. • One 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	**Text Books:** 1. Ramez Elmasri , Shamkant B. Navathe, Fundamentals of Database Systems, Pearson Education, 7th Edition 2. Abraham Silberschatz, Henry Korth, S. Sudarshan, Data Base System Concepts, McGraw Hill, 6th Edition **Reference Books :** 1. Raghu Ramakrishnan, Johannes Gehrke, Database Management Systems, McGraw Hill, 6th Edition 2. Peter Rob, Carlos Coronel, Database System Design, Implementation and Management, Course Technology Inc, 5th Edition 3. Sachin Deshpande, Distributed Databases, Dreamtech Press, 2014 **NPTEL Resources :** Database Management Systems : https://nptel.ac.in/courses/106/105/106105175/
Learning	On completion of the course students will be able to:-

Outcomes	**LO1.** Understand the fundamental elements of a database management systems. **LO2.** Compare and contrast between the existing data models and recognize emerging data models for databases. **LO3.** Design and develop a logical design model to represent database application scenarios. **LO4.** Transform the logical design model to relational model. **LO5.** Analyze and design an improved database through normalization. **LO6.** Understand the basic concepts of transactions processing in DBMS. **LO7.** Understand and recognize the emerging trends in Database Technology.

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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	Through this practical course learners will get to:- **CO1.** Learn to write object oriented programs **CO2.** Learn advanced concepts in object oriented approach **CO3.** Learn to program in Java language **CO4.** Learn use of Classes, Objects and Functions in Java

	Content	**No. of Hours (60)**
1	**Introduction to Java** Application/Use of language, Simple Programs, Data types, Control statements and Java Packages	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	08
4	**Constructors** Constructors: Default, Parameterized and Copy	08
5	**Polymorphism** Function Overloading	04
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	04
8	**Vectors, Collections(Linked lists, hash maps)**	12

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, 10^{th} Edition or later **NPTEL Resources** Programming in Java : https://nptel.ac.in/courses/106/105/106105191/
Learning Outcomes	On completion of the course learners will be able to:- **LO1.** Create object oriented programs. **LO2.** Use advanced concepts in object oriented systems while programming **LO3.** Program in Java language

Goa University

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	In this course the student learns :- **CO1.** Designing and conceptualizing a relational data model. **CO2.** Implementing the relational database concepts through some DBMS package **CO3.** Managing users and access control to data. **CO4.** Using a DBMS package 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	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	28

	Views	
3	**Transaction Processing** • Start Transaction • Commit • Rollback • Save point • Locks • Triggers • Stored procedures **Database Privileges and Roles** • Grant • Revoke • Public	20

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 method 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 **NPTEL Resources :** DBMS : https://nptel.ac.in/courses/106/105/106105175/ Database Design : https://nptel.ac.in/courses/106/106/106106093/
Learning Outcomes	On completion of the course learners will be able to : **LO1.** Implement and use a relational database management system. **LO2.** Design and implement relational database concepts using data definition language for a given problem-domain. **LO3.** Design, implement and manipulate the database schema using SQL queries for a given problem-domain. **LO4.** Design and implement transaction processing for a given database.

Goa University

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	This course is aimed :- **CO1.** To introduce the fundamentals of communication. **CO2.** To teach the process of interpersonal and group communication. **CO3.** To develop skills of communication and idea presentation. **CO4.** To hone soft skills in learners, grooming them for verbal communication.

	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 Software's • 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	**Text Books :** 1. Aspi Doctor, Rhoda Doctor, Principles and Practice of Business communication, Shet Publishers 2. S. M.Rai, Urmila Rai, Business communication, Himalaya Publishing House-Mumbai, 2015 3. Dale Carnegie, Public Speaking and Influencing Men in Business,Prabhat Prakashan. 4. Dr. C.S. Rajvinder, Communication, Himalaya Publishing House Mumbai 5. Geoffrey Moss, Persuasive Presentations, Vikas Publishing House Pvt. Ltd. **NPTEL Resources :** Communication Skills : https://nptel.ac.in/courses/109/104/109104031/ Interview Skills : https://nptel.ac.in/content/storage2/courses/109104030/Module8/Lecture26.pdf
Learning Outcomes	On completion of the course learners will:- **LO1.** Define the basic concept of communication and explain the complete communication process **LO2.** Describe the different methods, forms of communication **LO3.** Describe the process of conducting and appearing for a job interview **LO4.** Describe the aspects of matter researching and presentation preparation **LO5.** Explain the use modern aids and software of presentation

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	This course is aimed :- **CO1.** To learn the Concepts of Software Engineering **CO2.** To learn & understand Software Development Life Cycle, version control & release management concepts. **CO3.** To understand the agile approach of software development, using scrum framework & methodology. **CO4.** To learn various quality assurance concepts, approaches and tools. **CO5.** To know the basics of various modern and fourth generation software development techniques

	Content	**No. of Hours (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 • 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	**10**

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, 2018 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, Gopalaswamy Ramesh, Software Testing- Principles and Practices, Pearson Education India, 2014 7. Pankaj Jalote, Software Engineering: A Precise Approach, Wiley, 2010 **NPTEL Resources :** Object Oriented Analysis and design : https://nptel.ac.in/courses/106/105/106105153/
Learning Outcomes	On completion of the course students will be able to **LO1.** Describe the agile principles and practices. **LO2.** Describe modern software development methodologies. **LO3.** Implement the software life cycle models & appreciate the

	development process **LO4.** Implement the concept of version control & release management **LO5.** Perform scrum Release Planning, and Scrum Sprint Planning. **LO6.** Implement XP framework for design and development of software. **LO7.** Implement the strategies and methods of software quality assurance

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	This course is aimed to :- **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)**
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:** Functions 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 signaling, Analog Signaling, 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):** class full and classless Addressing, sub-netting. IPv4 vs IPv6. Network Address Translation (NAT), NAT and ISPs, Internetworking, Internet	10

	as a Datagram Network, Internet as a Connectionless Network, IPv4 Header. **Other Protocols:** ARP, RARP, ICMP. **Devices:** Routers	
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, 4th Edition 2. William Stallings; Data and Computer Communication; Pearson Education,7th Edition 3. J.S Katre; Computer Network Technology; Tech-Max Publications; 2010. 4. Fred Halsall; Data Communications, Computer Networks and Open Systems; Addison Wesley; 3rd Edition.

	5. D.P.Nagpal; Data Communication and Networking; S. Chand;1st Edition **References:** 1. Andrew S. Tanenbaum, Computer Networks, Pearson, 4th 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 , Addison Wesley, 3rd Edition 4. Nader F. Mir, Computer and Communication Networks, Pearson Education, 2007 5. Comer, Computer Networks and Internets with Internet Applications, Pearson Education, 4th Edition. 6. William Stallings, Data and Computer Communication, 6th Edition, Pearson, 2000 7. Norton Peter, Complete Guide to Networking, SAMS Publishing. 8. S.K.Basandra & S. Jaiswal, Local Area Networks, Galgotia Publications **NPTEL Resources :** 1. Computer Networks and Internet Protocol : https://nptel.ac.in/courses/106/105/106105183/ 2. Data Communication : https://nptel.ac.in/courses/106/105/106105082/
Learning Outcomes	On completion of the course learners will be able to:- **LO1.** Understand the basic components of a data communication system **LO2.** Identify the different types of network topologies and understand their advantages and disadvantages. **LO3.** Understand the basic protocols of computer networks, and how they can be used to assist in network design and implementation **LO4.** Understand IP addressing and analyse how to assign IP addresses in a network. **LO5.** Identify and compare the different types of Transmission media **LO6.** Recognize the different internetworking devices and understand their functionality. **LO7.** Explain the fundamentals of cryptography such as symmetric/asymmetric encryption, digital signatures, and hash functions.

Goa University

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

Prerequisites	Basic understanding of using internet and web browser
Objectives	This course is aimed to :- **CO1.** Learn to use centralised repositories and versioning tool, design and execute unit test cases using any testing tool. **CO2.** Learn to document code and generate documentation using documentation tool. **CO3.** Learn to use tool/s for debugging and defect tracking, code refactoring **CO4.** Understand and apply scrum methodology **CO5.** Learn and understand testing tool to test web application and 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 learners will be able to:- **LO1.** Implement centralized repositories and versioning tool. **LO2.** Design and execute test cases using testing tool. **LO3.** Design 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.** Implement tools to build and test web applications.

Goa University

Programme: B.C.A.
Course Code: CAC116 **Title of the Course:** User Interface Design Laboratory
Number of Credits: 02(P) **Effective from AY:** 2020-21

Prerequisites	Basic understanding of using internet and web browser
Objectives	**This course is aimed :-** **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	24

	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	
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 **NPTEL Resources** 1. User Interface Design : https://nptel.ac.in/courses/124/107/124107008/ 2. Internet Technology : https://nptel.ac.in/courses/106/105/106105084/
Learning Outcomes	**On completion of the course students will be able to :-** **LO1.** Design a user-interaction strategy that solves a real-world problem using design principles, guidelines, and heuristics. **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: CAA102 **Title of the Course:** Technical Writing Skills

Number of Credits: 04 **Effective from AY:** 2020-21

Prerequisites	Basic Communication and Presentation skill
Objectives	This course is aimed to :- **CO1**. Teach to document and report matter through written form. **CO2.** Use domain specific technical jargon in reporting. **CO3**. Write unambiguous documents in standard formats.

	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/ Reference Books	**Textbook :** 1. Aspi Doctor & Rhoda Doctor, Principles and Practice of Business communication, Sheth Publishers Private Limited **NPTEL Resources :** Technical English for Engineers : https://nptel.ac.in/courses/109/106/109106094/ Letter writing : https://nptel.ac.in/content/storage2/courses/109104030/Module5/Lecture13.pdf
Learning Outcomes	On completion of the course students will be able to:- **LO1.** Explain the principles of correspondence and jargon for business letters **LO2.** Explain the conventions, formats of business letter writing **LO3.** Design different types of documents **LO4.** Design effective reports by collect data from meetings, briefings

Annexure III

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

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

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	This course is aimed to :- **CO1**: Learn fundamental concepts, technologies and tools in web technologies. **CO2**: Learn frontend development tools for creating web pages. **CO3:** Learn client side and server side scripting. **CO4 :** Learn to design, develop and host a complete functional website. **CO5**: Learn security issues in web applications

	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 • Media tags • Background and text effects using CSS • 2D and 3D transformations in CSS • Display properties: inline, block, flex, grid, table • CSS Media queries	04
3	**Extensible Markup Language** • Introduction to XML • XML Namespaces • Document Type Definition (DTD) • XML Schemas • Transforming XML into XSLT	08
4	**Client side scripting** • 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	14

5	**Server side scripting** • 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	16
6	**Introduction to frameworks** • Overview, MVC architecture	06
7	**Web hosting and security** • Types of Hosting: Windows and Linux • Domain • Name Servers • Principles of web security • Cryptography • Digital certificates • Digital signatures • Secure Socket Layer	08

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 **NPTEL Courses** : Internet Technology : https://nptel.ac.in/courses/106/105/106105084/
Learning Outcomes	On completion of this course the learners will be able to : **LO1**: Design user friendly websites using HTML and CSS. **LO2**: Design 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: CAC118 **Title of the Course: Information Systems**

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

Prerequisites	None
Objectives	This course is aimed :- **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** • Data Processing • Transaction Processing • Application Processing • Information System Processing • OLAP for analyzing information	08
8	**Data Warehouse** • 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	08

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 learners will be able to :- **LO1** Explain the role of Information Systems in organizational Management to know knowledge, its classifications; capturing, storing and utilizing it in an organization **LO3** Describe the characteristics of decision making, decision making models and tools **LO4** Describe the concept of Office Automation Systems, Expert System and Executive Expert System **LO5** Compare different information systems such as ERP, SCM and CRM.

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	This course is aimed to:- **CO1.** To teach web page creation and scripting. **CO2.** To implement web tools to create web applications. **CO3.** To learn client side and server side scripting.

	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** Introduction, basic operators, input/output statements, decision statements, looping statements, functions, DOM (document object model), form validation, mouse and keyboard events, AJAX	12
3	**Extensible Markup Language** XML Structure, XML with Data Source Object, Document Type Definition, Schemas, Namespaces, Transformation Style Sheet, Parsers, Documents and Database	04
4	**Client-side web framework** Downloading and installing framework, understanding responsive web, grid system, Row and Container Classes, Navbar, Carousel, tables, forms, images, Glyphicons	12
5	**Server-side Scripting** Introduction, input/output Statements, decision statements, looping statements, functions, database connectivity, CRUD (Create, Update, Read and Delete) operations, session and cookies	12
6	**Server-side web framework** Downloading and installing framework, Introduction, modules, libraries, APIs, web services, security	12
7	**Web hosting and Security** 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	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. • 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 **References:** 1. Paul Deitel, Internet and world wide web-How to Program, Pearson Education, 5th Edition **NPTEL Courses** : Internet Technology : https://nptel.ac.in/courses/106/105/106105084/
Learning Outcomes	On completion of the course learners will be able to:- **LO1**: Design complete and functional web applications. **LO2**: Design client and server side scripts. **LO3**: Design responsive and dynamic websites. **LO4**: Demonstrate hosting of 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	This course is aimed at :- **CO1 :** Introducing terminologies and technologies in multimedia. **CO2 :** Learning different types and forms of multimedia. **CO3 :** Learn storage and access mechanism of each multimedia file type.

	Content	**No. of Hours (60)**
1	**Introduction to Multimedia** • Multimedia – Types , Applications • Multimedia Design Principles • Multimedia Technologies - Image(Graphic), Sound(Audio), Motion Picture(Video)	**08**
2	**Graphic Media** • 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)	**16**
3	**Audio Media** • 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) o Uncompressed: PCM, WAV, AIFF o Lossy: MP3, AAC, WMA lossy o Lossless: FLAC, ALAC, WMA lossless • Audio Streaming & Podcasting • Audio effects & editing platforms	**14**
4	**Video Media** • 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) o Video Codec H.264, MPEG-4, DivX, MPEG-2, HEVC (H.265) o Video Containers: MP4, AVI, MOV, FLV, WMV, Matroska, VOB, AVCHD • Principles of Video Production- Making, Pre Production (concept , outline,	**16**

	Script, storyboard) and Post Production (Visual effects, Distribution , editing , Colour Correction)) • Recording and broadcasting • Video Editing	
5	**Other Media** • Web culture and Media • Print Media	**06**

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, Tata Mc-Graw Hill., 9th Edition 2. Buford, Multimedia Systems, Pearson edition, 2003 **References** 1. Vasuki Belavadi, Video Production, Oxford University Press India; 2nd Edition 2. Ted Alspach, Jennifer Alspach, Illustrator CS Bible, John Wiley & Sons, 1st edition 3. Ranjan Parekh, Principles of Multimedia, TMH, 2nd Edition, 2017 4. Ralf Steinmetz and Klara Nahrstedt, Multimedia: Computing, Communication and applications, Springer, 2004 5. Adobe Creative Team, Adobe Audition CS6 Classroom in a Book, Adobe **Web References** Mediacollege.com **NPTEL Resources** : Multimedia Processing : https://nptel.ac.in/courses/117/105/117105083/
Learning Outcomes	On completion of this course learners will be able to :- **LO1** : Explain the different types and forms of multimedia. **LO2** : Describe the issues and principles in design and use of Multimedia. **LO3** : Explain the concepts of graphic media and colour modes **LO5** : Design 3D models **LO6** : Choose the best suitable 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	This course is aimed to :- **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** 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	**06**
8	Security Issues in E-Commerce Risks of e-commerce, Types and sources of threats to e-commerce ; Protecting	**10**

	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 **NPTEL Resources** : https://nptel.ac.in/content/storage2/courses/106108103/pdf/PPTs/mod13.pdf
Learning Outcomes	On completion of the course students will be able to :- **LO1.** Describe the basics of e-commerce. **LO2**. Explain the design principles of e-commerce websites. **LO3**. Explain the different models of e-commerce. **LO4**. Describe the different electronic payment systems. **LO5**. Explain the security issues, security mechanism and threats to ecommerce applications.

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	This practical course is aimed at :- **CO1:** Learning to process the different types of multimedia files. **CO2:** Learn graphics editing through a graphic manipulation tool. **CO3 :** Learn to record and manipulate audio files. **CO4 :** Learn to captures and process video streams. **CO5 :** Learn computer based animations	
Content		**No. of Hours (60)**
1	**Graphic Media** Graphics capturing and storage Conversion from one format to another Graphic Packages	16
2	**Audio Media** Audio recording Audio storage and conversion Audio mixing Audio editing packages	12
3	**Video Media** Video Capturing and Editing Video Effects and transitions Video composition, story boarding, rendering Video editing package	16
4	**Animation** 2D/3D character modeling 2D, 3D Animation Techniques 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	**Text Books:** 1. Ranjan Parekh, Principles of Multimedia, TMH, 2nd Edition, 2017 2. Brie Gyncild, Adobe Photoshop CS6,Pearson Education 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 **NPTEL Courses** : Multimedia Processing : https://nptel.ac.in/courses/117/105/117105083/
Learning Outcomes	On completion of the course students will be able to :- **LO1**: Explain the various image editing features on images. **LO2:** Design and edit audio streams **LO3**: Capture videos and apply different editing effects on videos **LO4**: Design 2D, 3D animations

ANNEXURE IV

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

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	The coursed is aimed to :- **CO1.** Learn he concepts and the technical skills needed to secure Information. **CO2.** Study the different vulnerabilities of applications and for corrective measures and protection. **CO3.** Study the concepts, tools and techniques for enforcement of Security Policies. **CO4.** Learn the different types of Cryptography and Computer Forensics.

	Content	**No. of Hours (75)**
	Theory	**45**
1	Digital Securities Introduction **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	**09**
2	**Online Anonymity** The Android Software Stack, Android Runtime - ART, Android Runtime – Core Libraries, Java Interoperability Libraries, Android Libraries, Application Framework, Restful and Non Restful APIs	**06**
3	**Cryptography and Secure Communication** **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	**10**
4	**Cyber Crime Issues and Investigation** **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	**10**

	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** 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.	**10**
	Practical	**30**

Suggested List of Practicals :

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/ Reference Books	**Text 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. **NPTEL Resources :** Cryptography and Network Security : https://nptel.ac.in/courses/106/105/106105031/
Learning Outcomes	On completion of the course learners will be able to **LO1.** Identify security risks and take preventive steps. **LO2.** Investigate cybercrime and collect evidences **LO3.** Demonstrate 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	This course is aimed :- **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** 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	**05**
2	**Understanding Hypervisors** 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	**07**
3	**Understanding Virtual Machines** 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	**06**
4	**Creating a Virtual Machine** 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	**04**
5	**Managing CPUs for a Virtual Machine** Understanding CPU Virtualization	**05**

	*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** **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	**08**
7	**Managing Networking for a Virtual Machine** Understanding Network Virtualization *Configuring VM Network Options *Tuning Practices for Virtual Networks **Managing Additional Devices:** Using Virtual Machine Tools, Understanding Virtual Devices	**05**
8	**Understanding Availability in a Virtual Machine** 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	**05**
	Practical	**30**

Suggested List of Practicals :

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 **NPTEL Resources :** Cloud Computing and Distributed Systems : https://nptel.ac.in/courses/106/104/106104182/
Learning Outcomes	On completion of the course learner will be able to :- **LO1.** Explain the concepts of Virtualization, Hypervisors, & Virtual Machines **LO2.** Create Virtual Machine and install Operating Systems. **LO3.** Implement the management of 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.** Describe the 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	This course is aimed to :- **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** **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	06
2	Activities, Fragments, & Intents **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	07
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** **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	07
5	**Displaying Pictures & Menus With Views** **Image Views to Display Pictures** - ImageView View, ImageSwitcher, GridView **Menus with Views** - Helper Methods, Options Menu, Context Menu, **WebView**	04
6	**Data Persistence** **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	05
7	**Content Providers** **Sharing Data in Android** **Using a Content Provider** -Predefined Query String Constants, Projections, Filtering, Sorting **Creating Own Content Providers -** Using the Content Provider	04
8	**Messaging & Location-Based Services** **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**	**05**
Practical		**30**
Suggested List Practicals:		

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/ Reference Books	Text 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 **NPTEL Resources :** Mobile Computing : https://nptel.ac.in/courses/106/106/106106147/
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	This course is aimed 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** 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.	04
2	**Principles of Animation** 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	04
3	**Fundamentals of drawing and design** 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.	05

4	**Color Theory and Graphics** 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.	04
5	**Introduction to Digital Imaging** 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	06
6	**2D Animation tools processing** 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.	08
7	**Basics of 2D Animation** 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.	08
8	**Motion Data Processing** History of motion capture, recording actions of human actors, and using that information to animate digital character models in 2D computer animation	06
	Practical	**30**

List of suggested Practicals :

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/ Reference Books	**Text Books** 1. Mary Murphy, Beginner's Guide to Animation: Everything you need to know to get started, Watson-Guptill 2. 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 **NPTEL Resources :** Introduction to Computer Graphics : https://nptel.ac.in/courses/106/102/106102065/
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	This course is aimed :- **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** 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	**05**
2	**Line, circle, and polygon** 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 Fill algorithm	**10**
3	**2D Concepts** 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,	**10**

	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** 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	**10**
5	**Curves & Surfaces** 5.1 Shape description requirements , parametric functions 5.2 Surface Topology and Curvature 5.3 Spline representations 5.4 Bezier curves and Bezier surfaces.	**05**
6	**Graphic Systems** 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.	**05**
	Practical	**30**

List of Suggested Practicals

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/ Reference Books	**Text 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. **NPTEL Resources :** Introduction to Computer Graphics : https://nptel.ac.in/courses/106/102/106102065/
Learning Outcomes	The learners after undergoing this course will be able to: **LO1** Describe the concepts of computer graphics system. **LO2** Implement the algorithms to draw lines, circles and polygons. **LO3** Perform transformation techniques to scale, rotate and translate the object. **LO4** Perform 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	This course is aimed to : **CO1** Introduce 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 Practicals :

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 **NPTEL Resources** : Human Computer Interaction : https://nptel.ac.in/courses/106/103/106103115/
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	This course is aimed to : **CO1.** Develop the skill & knowledge in 3D Modelling and Animation **CO2.** Understand the concepts of 2D Splines, shapes & compound objects **CO3.** 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** 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.	**06**
2	**2D Splines & Shapes & compound object** 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.	**04**
3	**3D Modelling** 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	**06**
4	**Key frame Animation** 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.	**06**
5	**Simulation & Effects** 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	**06**

	modifier, cloth & garment maker modifiers etc.	
6	**Lighting& Camera** 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.	**06**
7	**Texturing with Max/Maya/Blender** 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.	**06**
8	**Rendering with V-Ray** V-ray light setup, V-ray rendering settings, HDRI Illumination, Fine-tuning shadows, Final render setting etc.	**05**
	Practical	**30**

List of suggested Practicals :

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 **NPTEL Resources** CAD : https://nptel.ac.in/courses/112/102/112102102/#
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. **Application Profiling:** Manual Inspection, Search Tools for Profiling, Automated Web Crawling, General Countermeasures.	**09**
2	**Bypassing and Attacking Web Authentication** **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	**08**
3	**Penetration Testing and Input Injection Attacks.** **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.	**10**
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** 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.	**08**
Practical		**30**

List of suggested Practicals :

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 **NPTEL Resources** Ethical Hacking : https://nptel.ac.in/courses/106/105/106105217/
Learning Outcomes	On completion of the course student will be able to:- **LO1.** Explain the various threats to a web application. **LO2.** Perform various input injection attack simulations. **LO3.** Explain counter measures against various input injection attacks. **LO4.** Perform 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	The course aims :- **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** 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	**08**
2	I**OT Platforms Design Methodology** Introduction to various steps involved in IOT systems design methodology	**05**
3	**IOT Boards** **Arduino :** Introduction, Arduino Pinout, Types, Programming Arduino using online and offline IDEs **Raspberry Pi** : Introduction, Raspberry Pi Pinout, Types, Programming RaspberryPi using Python.	**10**
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. **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	**12**

5	**IoT Case Study** **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.	**10**
	Practical	**30**

List of suggested Practicals :

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) **NPTEL Resources** Introduction to Internet of Things : https://nptel.ac.in/courses/106/105/106105166/
Learning Outcomes	On completion of the course student will be able to **LO1** : Explain the concepts of Internet of Things and gain knowledge to design IoT applications **LO2** : Describe the 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	Knowledge of Python Language
Objectives	The course aims to :- **CO1** : Learn fundamentals of Data Analysis and the Science behind it. **CO2** : Learn Machine Learning algorithms for performing complex data analysis. **CO3** : Learn Analyst's insight into a data set and its underlying structure. **CO4** : To suggest hypotheses about the causes of observed phenomena. **CO5** : 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 • Cleaning Data - Missing Values, Outliers • Preparing Data for Modeling - Transformations, Derived Variables • Visualization Methods and Applications • Case Studies	04
3	**Feature Selection and Dimensionality Reduction** • Why to do Feature Selection? • Feature Selection Techniques • Feature Selection vs Dimensionality Reduction	04
4	**Introduction to Machine Algorithms** • Overview of Machine learning • Overview of Statistical learning • Supervised Versus Unsupervised Machine Learning • Regression Versus Classification Problems	02
5	**Regression And Classification Models** • Simple Linear Regression • Multiple Linear Regression • Linear Discriminant Analysis • Logistic Regression • Naive Bayes • K-Nearest Neighbours • Artificial Neural Networks	16

6	**Tree Based Models** • Basics of Decision tree • Bagging and Boosting • Random Forest • Gradient Boosting Machines	08
7	**Unsupervised Learning** • Overview of Clustering • K-means Clustering • K-medoid	05
8	**Association** • Overview of Association Rule Mining • Market Basket Analysis	04
	Practical	**30**

List of of suggested practicals :

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. • Tools required for Practical , Programming Languages : Python and R Packages required : numpy, pandas, scikit-learn • Data Science Methodology 1) Problem to Approach 2) Requirements to collection 3) Understanding to preparation 4) Modelling to Evaluation 5) Deployment to Feedback
Textbooks/ Reference Books	**Text Books** 1. Jiawei Han, Micheline Kamber, Data Mining Concepts and Techniques, Morgan Kaufmann, 3rd Edition, 2011.

	Reference Books 1. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Introduction to Data Mining, Person Education, 2016. 2. K.P. Soman, Shyam Diwakar and V. Ajay, Insight into Data mining Theory and Practice, Prentice Hall of India, 2016. 3. G.K. Gupta, Introduction to Data Mining with Case Studies, Prentice Hall of India, 3rd Edition, 2014 **NPTEL Resources** 1. Python for Data Science : https://nptel.ac.in/courses/106/106/106106212/ 2. Introduction to Data Analytics : https://nptel.ac.in/courses/110/106/110106064/ 3. Data Mining : https://nptel.ac.in/courses/106/105/106105174/
Learning Outcomes	On completion of the course the student will be able to : **LO1** : Implement problems or subset of problems which the Industry is currently working upon. **LO2** : Perform Data Wrangling and Data Analysis **LO3** : Perform Feature Selection and Dimensionality Reduction. **LO4** : Implement Machine Learning Algorithms **LO5** : Perform Supervised and Unsupervised Machine Learning **LO6** : Choose Machine Learning Algorithm given a data mining problem

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	The course aims 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** Understanding of Operating system concepts, Multiprocessor architecture, Process affinity, Memory, Computer Network, IP Addressing, Subnetting and Supernettting, Designing LANs	**08**
2	**Introduction Computing Paradigms and Cloud Computing** 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.	**10**
3	**Infrastructure as a Service** 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.	**15**
4	**Platform as a Service** 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	**06**

5	**Software as a Service** 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	**06**
	Practical	**30**

List of suggested Practicals:

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. **NPTEL Resources :** Cloud Computing and Distributed Systems : https://nptel.ac.in/courses/106/104/106104182/
Learning Outcomes	On completion of the course learners will be able to:- **LO1** Explain the fundamentals of computing paradigms and cloud computing **LO2** Describe the cloud architecture and types **LO3** Describe the service and deployment models of cloud L**O4** 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	The course aims to :- CO1: provide 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** • Traditional Content Delivery Systems • Need for Content Organization • Merits /Demerits of CMS • Planning and Developing Dynamic Web Content Sites	02
2	**Planning and Developing Dynamic Web Content Sites** • 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	03
3	**Building and Administrating a WordPress Blog Site** • 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.	07
4	**Building an Online Social Network Using SocialGo** • 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	04

5	**Building and administration of Prestashop based website** • Installing and configuring Prestashop, using a theme and various modules of Prestashop to build fully functional website with admin panel .	04
6	**WebSite Design Using CSS** • 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	03
7	**Creating and Maintaining a Wikimedia site** • Installing and formatting Media Wiki, Creating and editing separate wiki entries, • Adding coding functionality and hyperlinks • Creating and Maintaining a Wikimedia site	04
8	**To learn to work with Wix** • Setting up a Wix account • Laying out pages; using template features • Adding site content features • Creating interactive links. • CMS Development using Wix	03
9	**Creating Online Courses Using Moodle** • Planning and designing online training materials. • Installing the Moodle LMS platform software. • Adding media features to online courses. • Adding quiz and grading options.	07
10	**Building Websites Using Joomla** • Acquiring a host for Joomla. • Installing Joomla, • Exploring the Admin Interface, • Planning the website. • Joomla plugins	06
11	Comparison of Various CMS Tools • Comparative analysis of features of CMS Tools	02
	Practical	**30**

List of suggested Practicals :

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 : LO1: Create dynamically manageable CMS LO2: Configure and use Word Press CMS LO 3: Work with SocailGo CMS LO4: Design quality CMS sites using CSS LO5: 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	The course aims to : CO1: learn directing traffic to a website. CO2: implement Web Analytics, Search Engine Optimization, and Search Engine Marketing. CO3: analyze data and assessing reports on traffic to web sites; CO4: learn 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 • Role of search engines spiders/Robots • Designing search engine spiders • Optimizing Search Strategies	**02**
3	**Site Architecture and Keyword Selection** • 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	**05**
4	**Content Design and Page Optimization** • 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	**08**

	• Create unique content, build infographics, • Rewriting content in avoiding duplication or plagiarism issues • avoid Search engine penalization	
5	**Linking Strategies** • 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	**04**
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** • 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	**04**
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	**06**

	• 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	
Practical		**30**

List of suggested Practicals :

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. o Give an individual Final semester Project to select/build a site built by student to apply analytics, SEO and SEM strategies. o Complete initial SEO of individual project site o Write 1-page summary of organic traffic on group site. o Discuss effect of designs on organic traffic. o Complete landing page Complete tweaks to site to improve your conversion rate o 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** The Rise of Full-stack JavaScript, Node.js, The Node.js Ecosystem, MongoDB, AngularJS	02
2	**Node.js** 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.	04
3	**Node's Programming Model** 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.	10
4	**MongoDB** 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.	04
5	**Interacting with MongoDB Using Mongoose** Mongoose Node Module, Schemas, Mongoose Models, Creating More Documents, Simple Queries, Updating.	03
6	**Express** 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	10

7	Angular JS 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.	12
Practical		30

List of suggested Practicals :

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**
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** • 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	**10**
6	**Important features** • Bank Reconciliation • Export and Import of data • Data Security and Backup • Zero Valued Transactions • Configurable Invoicing • Stock Transfer • Cheque Printing	**08**

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/ **NPTEL Resources :** 1. Financial Accounting : https://nptel.ac.in/courses/110/101/110101131/ 2. Managerial Accounting : https://nptel.ac.in/courses/110/101/110101003/
Learning Outcomes	The student after undergoing this course will be able to: **LO1.** Perform finalization of Accounts and other aspects related to E-Accounting. **LO2.** Perform 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	The course aims to : **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 • Picture Manager	**18**
3	**Communication** • Common Network environments and the effects of using them, • Communication with other ICT users using email	**10**

	• Effective use of the internet • Search Engines • Blogs • Collaborative Software	
4	**ICT for Educational Administration and Management: Learning Management Systems** • 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	**20**

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 **NPTEL Resources** Modern Digital Communication Techniques : https://nptel.ac.in/courses/117/105/117105144/

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	**CO5.** 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 • 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	40
2	**Google Classroom** • Features and concept of Google classroom • Creating and joining classroom • Adding announcements and lesson materials • Adding and grading assignments	04

	• Managing students	
3	**Google Meet** • 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)	04
4	**Google Drive** • Setting up drive on your devices • Storing files in drive • Finding and viewing files • Sharing files inside and outside of an organization • Troubleshooting errors	04
5	**Youtube** • YouTube basics • Branding your channel • YouTube policies and guidelines	04
6	**Google Analytics** • Introduction • Google Analytics Interface • Basic Report • Basic campaign and conversion tracking	04

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 Perform basic operations using 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** 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	08
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** **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	08
	Contributing to Open Source Projects: Introduction to GitHub, interacting with the community on GitHub, open source code, reporting issues, contributing code.	04
6.	Introduction to Libre Office, Bluefish, GIMP / Pinta, Stellarium, Audacity, OpenShot Video editor, Camstudio	16

List of suggested practicals:

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 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.	12
2.	**Introduction to Windows Form Controls** • 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.	12
3.	**Additional Controls and Menus of Windows** • 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.	12
4.	**In-built Functions and Dialog Box** • 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	12
5.	**Basic SQLs** • Working with basic SQL commands for insert, delete, update, Selects	06

6	**Database Programming- ADO.NET** • 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	06

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. **CO**4: 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 • Familiarization with the GUI & Command line processing • Logging in & out of the system & Shutting down & rebooting • Familiarization with User & system applications.	08
2.	**UNIX file system** • UNIX File System • UNIX File types • UNIX Directory structure and special purpose directories(eg. /dev /proc)	04
3.	**Unix/ Linux Commands** • Basic commands and using command history • Commands to o Navigating the Filesystem: pwd, ls, mkdir,rmdir, lsblk, mount,df o move around the ., .. & hidden directories and to move around by path concept, o creating new directories, o creating files –touch , cat ; copying files; moving files, o current working directory, referring to home directories, o Deleting files and directories; o A look at /proc, /dev /etc /var o looking at files : cat, more, pg, less , head , tail; banner, file, wc,comm,ln,cmp, dd, alias,sort, cut, grep ,cmp,, diff, uniq , bc ; o Getting online help;	16

	○ 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** • 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	12
5	**Editor and Shell Scripting** • 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	12

	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** • 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	08

List of Suggested Practicals :

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 **NPTEL Resources** : Linux Programming and Scripting : https://nptel.ac.in/courses/117/106/117106113/
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	The course aims to **:** **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
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
3	Descriptive statistics • Central tendency • Variation • Installing data analysis pack and calculating descriptive statistics • Shapes • Arrays	06
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	**08**

	• P value • Sample t test • Two sample t test • Two sample p test • F and Chi square	
8	ANOVA • Formulae and calculations in ANOVA • Two factor ANOVA	**06**
9	Goodness of fit and contingency table • Goodness of fit • Contingency table	**04**
10	Correlation and linear regression • Correlation • Linear regression	**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	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 **NPTEL Resources** Introduction to Data Analytics : https://nptel.ac.in/courses/110/106/110106072/
Learning Outcomes	The student after undergoing this course will be able to : **LO1.** Apply Descriptive and Inferential Statistics **LO2.** Perform Statistical problems using software **LO3.** Perform software-based advance level statistical analysis **LO4.** Analyse given data using software to make fact based decisions.

Annexure VI

Additional Generic Electives proposed						
Course Code	**Course Title**	**Course Credits**	**AY**	**Marks**	**Semester**	**Hours**
CAG-107	Critical Thinking and Problem Solving	4(T)	2020-21	100	1/II/III/IV	60
CAG-108	Data Analyses and Statistical Techniques	4(T)	2020-21	100	1/II/III/IV	60
CAG-109	Public Administration	4(T)	2020-21	100	1/II/III/IV	60
CAG-110	Ergonomics	4(T)	2020-21	100	1/II/III/IV	60
CAG-111	Social Engineering	4(T)	2020-21	100	1/II/III/IV	60
CAG-112	E-Waste Management	4(T)	2020-21	100	1/II/III/IV	60
CAG-113	Ethics and CSR	4(T)	2020-21	100	1/II/III/IV	60
CAG-114	Business Infrastructure and Management	4(T)	2020-21	100	1/II/III/IV	60
CAG-115	Information Security	4(T)	2020-21	100	1/II/III/IV	60
CAG-116	Decision Making and Mathematical Models	4(T)	2020-21	100	1/II/III/IV	60
CAG-117	IT in Management	4(T)	2020-21	100	1/II/III/IV	60
CAG-118	Data Mining and Business Intelligence	4(T)	2020-21	100	1/II/III/IV	60
CAG-119	Micro Economics	4(T)	2020-21	100	1/II/III/IV	60
CAG-120	Monetary Economics	4(T)	2020-21	100	1/II/III/IV	60
CAG-121	Digital Marketing Fundamentals	4(T)	2020-21	100	1/II/III/IV	60

CAG-122	Social Media Marketing & Analytics	4(T)	2020-21	100	1/II/III/IV	60
CAG-123	Investment and Portfolio Management	4(T)	2020-21	100	1/II/III/IV	60
CAG-124	General Insurance	4(T)	2020-21	100	1/II/III/IV	60
CAG-125	Green Computing	4(T)	2020-21	100	1/II/III/IV	60
CAG-126	Research Methodology	4(T)	2020-21	100	1/II/III/IV	60

Goa University

Programme: B.C.A.

Course Code: CAG107

Title of the Course: Critical Thinking and Problem Solving Techniques

Number of Credits: 04 **Effective from AY:** 2020-21

Prerequisites	None
Objectives	The course aims : **CO1.** To understand and explain the importance of critical thinking **CO2.** To understand the core concepts associated with critical thinking **CO3.** To Construct a logically sound and well-reasoned argument **CO4.** To Apply problem solving steps and tools **CO5.** To Identify appropriate solutions using specific approaches **CO6.** Critical thinking process to build, analyze and evaluate varying viewpoints in solving problems **CO7.** The best technique for making decisions **CO8.** To Avoid common decision-making mistakes

	Content	**No. of Hours (60)**
1	**Thinking and reasoning** • Thinking as a skill • An introduction to critical thinking • Solutions not problems	04
2	**Critical Thinking Basics** • Claims, assertions, statements • Judging claims • Argument - Identifying arguments - Analysing arguments - Complex arguments • Conclusions - Reasons - Assumptions - Flaws and fallacies	10
3	**Problem solving Basics** • What do we mean by a 'problem'? • How do we solve problems? • Selecting and using information • Processing data • Finding methods of solution • Solving problems by searching	16

	• Recognizing patterns • Hypotheses, reasons, explanations and inference • Spatial reasoning • Necessity and sufficiency • Choosing and using models • Making choices and decisions	
4	**Critical Thinking Application** • Inference, Explanation, Evidence, Credibility • Critical thinking and science • Introducing longer arguments • Applying analysis skills • Critical evaluation	10
5	**Advanced problem solving** • Combining skills – using imagination • Developing models • Carrying out investigations • Data analysis and inference • Using other mathematical methods • Graphical methods of solution • Probability, tree diagrams and decision trees	12
6	**Advanced Critical Reasoning** • Conditions and conditionals • Soundness and validity: a taste of logic • Non-deductive reasoning • Reasoning with statistics • Decision making • Principles	08

Pedagogy:	• Course delivery pattern, evaluation scheme, prerequisite shall be discussed at the beginning. • Lectures preferably to be conducted with the aid of multimedia 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.

	• To promote critical thinking, it is suggested to have activity based teaching. Some of the suggested methods are Classroom Assessment Techniques, Cooperative Learning Strategies, Case Study /Discussion Method, Using Questions, Conference Style Learning, and Use Writing Assignments.
Text Books / Reference Books	**Suggested Reference Books:** 1. John Butterworth and Geoff Thwaites, Thinking Skills : Critical Thinking and Problem Solving, Cambridge University Press, 2nd Edition 2. Robert Arp and Jamie Carlin Watson, Critical Thinking: An Introduction to Reasoning Well, Bloomsbury Academic, 2nd Edition 3. Joe Y. F. Lau, An Introduction to Critical Thinking and Creativity: Think More, Think Better, Wiley, ISBN: 9780470195093 4. Brooke Noel Moore and Richard Parker, Critical Thinking,, ISBN: 978-0-07-338667-6 , TMH, 12th Edition **NPTEL Resources** Introduction to Problem Solving and Programming : https://nptel.ac.in/courses/106/104/106104074/
Learning Outcomes:	On completion of the course the student will be able to : **LO1.** Define and explain critical thinking and its need **LO2.** Identify relevant arguments (reasons, claims, pros and cons, etc.) **LO3.** Analyze and evaluate claims, assertions, and arguments **LO4.** Predict implications and consequences **LO5.** Construct well-reasoned solutions/conclusions **LO6.** Implement problem solving approaches, tools with well reasoned view point **LO7.** Implement critical thinking process to build, analyze and evaluate decisions **LO8.** Demonstrate the application of various problem solving approaches **LO9.** Demonstrate the understanding of deductive and non-deductive reasoning

Goa University

Programme: B.C.A.

Course Code: CAG108 **Title of the Course:** Data Analyses & Statistical Techniques

Number of Credits: 04 **Effective from AY:** 2020-21

Prerequisites	None	
Objectives	In this course the student will learn : **CO1.** Concepts of analyzing data using Mathematical and Statistical Techniques. **CO2.** Basic Data Mining	
Content		**No. of Hours (60)**
1	**Probability and Distribution** Introduction Experiments Counting, Rules and Assigning Probabilities Events and their Probabilities Distribution, Some basic Relationships of Probability Conditional Probability, Baye's Theorem Normal Distribution, Poisson Distribution	12
2	**Sampling Distribution & Testing of Hypothesis** Introduction to Sampling Simple Random Sampling Estimation Point Estimation Interval Estimation Introduction to Sampling Distributions - Sampling Distribution - Other Sampling Methods Population Mean: σ Known, σ Unknown Determining the Sample Size Population Proportion	12
3	**Correlation and Regression** Measures of Association between Two Variables - Covariance - Correlation Introduction to Regression - Simple linear Regression Model - Least Square Method	08

4	**Statistics** Introduction: - Definition of statistics - Data and Collection of data - Summarizing Qualitative and Quantitative Data - Frequency Distribution - Graphs: Frequency Polygon, Histogram Measures of location Mean • Median • Mode • Percentiles • Quartiles • Weighted Mean • Working with Grouped Data Measures of Variability	16
5	**Data Mining** • Introduction • Knowledge Discovery Process • Use and Applications Mining Item Sets and Association Rules • Frequent Item Set Mining • Apriori Algorithm • Association Rule Mining Classification and Clustering • Classification - Definition - Model Construction - Model Usage • Clustering - Definition - Distance Measure - Clustering Types - K-means - K-medoid • Outlier Analysis - Definition - Example -	12

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 • Computational Skills by use of Tools • Active Learning • Application Based Learning
Text Books / Reference Books	Text Book : 1. S. P. Gupta, Statistical Methods, S. Chand, 30th Edition 2. Rudolf Freund, Donna Mohr, William Wilson, Statistical Methods, , Hardcover ISBN: 9780123749703 eBook ISBN: 9780080961033, Academic Press, 3rd Edition
Learning Outcomes:	On completion of the course the student will be able to : **LO1.** Perform probability and probability distributions on data. **LO2.** Perform testing of hypothesis on a population based on statistical measures of samples. **LO3.** Perform simple linear regression analysis. **LO4.** Compute descriptive statistics including diagrammatic representation and interpretation. **LO5.** Perform basic tasks in data mining

Goa University

Programme: B.C.A.
Course Code: CAG109 **Title of the Course:** Public Administration
Number of Credits: 04 **Effective from AY:** 2020-21

Prerequisites	None
Objectives	In this course the learner will learn : **CO1.** To provide an understanding on the evolution and scope of Public Administration. **CO2.** To understand Public Administration in the age of LPG. **CO3.** The emerging techniques and tools in Public Administration. **CO4.** To understand the Indian Administrative System. **CO5.** To understand the aspects of Personnel Administration. **CO6.** To cover the concepts of Financial Administration and Accountability. **CO7.** To learn and understand the challenges to Indian Administration.

	Content	**No. of Hours (60)**
1	**Introduction to Public Administration** Meaning, Scope, Evolution of Public Administration as a discipline	06
2	Public Administration in the age of Liberalisation, Privatisation and Globalisation New Public Management, Good Governance, Public Choice Approach	06
3	**Emerging Techniques and Tools in Public Administration** E-Governance, Public-Private Partnership, Critical Path Method, Programme Evaluation and Review Technique, Management Information System	08
4	**Indian Administrative System** British Legacy, Constitutional Context, Basic Features	10
5	**Personnel Administration** Recruitment All-India Services, Central Services and State Services, Training: All-India Services, Central Services, Training: State Services (Maharashtra)	10
6	**Financial Administration and Accountability** Budgetary Process, Parliamentary Committees: Public Accounts Committee, Estimates Committee, Committee on Public Undertakings, Comptroller and Auditor General	10
7	**Challenges to Indian Administration and Remedies** Corruption I: Causes, and Remedies-Anti-Corruption Law, Anti-corruption Bureau, Central Vigilance Commission, Corruption II: Remedies- Lokayukta and Lokpal, Citizens' Charters	10

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	Text Book : 1. Lamikant M., Public Administration, Tata McGraw Hill,, 2011. Reference Books: 1. Arora Ramesh and Rajni Goyal Indian Public Administration: Institutions and Issues, Wishwa Publication, 12th Edition. 2. Sharma, M. K., Financial Administration, Anmol Publication, 2006 3. Fadia, B. L., Fadia Kuldeep, Indian Administration, Sahitya Bhavan, SBP Publishers, 2009.
Learning Outcomes	On completion of the course the student will be able to : **LO1.** Explain the evolution and scope of Public Administration. **LO2.** Describe Public Administration in the age of LPG. **LO3.** Describe the emerging techniques and tools in Public Administration. **LO4.** Describe the Indian Administrative System. **LO5.** Describe the aspects of Personnel Administration. **LO6.** Describe the concepts of Financial Administration and Accountability **LO7.** Describe the challenges to Indian Administration.

Goa University

Programme: B.C.A.
Course Code: CAG110 **Title of the Course:** Ergonomics
Number of Credits: 04 **Effective from AY:** 2020-21

Prerequisites	None
Objectives	The course aims to : **CO1.** Learn broad based introduction to ergonomic principles and their application in the design of work, equipment and workplace. **CO2.** Learn Musculo-skeletal disorders, manual handling, ergonomic aspects of the environment . **CO3.** Learn the key features in the design of workplaces **CO4.** Learn the sources of standards covering ergonomics, social aspects and training, instruction and supervision requirements.

	Content	**No. of Hours (60)**
1	**Overview of Ergonomics** Introduction General Principles, Aims, objectives and benefits of ergonomics, Biological Ergonomics, Psychology, Developing an Ergonomics Strategy at Work	10
2	**Ergonomics Methods and Techniques** Work Design, Ergonomics Risk Assessment, Measurements and Information Gathering	10
3	**Musculo-Skeletal Disorder** Manual Handling, Work Related Upper Limb Disorders (WRULD)	10
4	**Workplace, Job and Product Design** Workplace Layout and Equipment Design, Controls, Displays and Information	10
5	**Relevant Physical Factors of the Work Environment** Lighting, Noise, Thermal Environment, Other Considerations, Clothing and Protective Equipment	10
6	**Standards and Social Aspects** Standards, Selection and Training, Instruction and Supervision	10

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 are achieved. It incorporates designing of problems, analysis of solutions submitted by the students groups.

Textbooks/ Reference Books	**Recommended Text Books:** 1. Konz SA, Johnson S. Work Design: Industrial Ergonomics, , Holcomb Hathaway Publishers, 6th Edition, 2004. 2. Konz SA, Johnson S. Work Design: Occupational Ergonomics., Holcomb Hathaway Publishers, 7th Edition, 2008. 3. Jan Dul , Bernard Weerdmeester, Ergonomics for Beginners, CRC Press; 3rd Edition 4. Celine McKeown, Michael Twiss , Workplace Ergonomics: A Practical Guide, IOSH services, 2001 **NPTEL Resources** Ergonomics for Beginners : Industrial design Perspective https://nptel.ac.in/courses/107/103/107103004/ Applied Ergonomics https://nptel.ac.in/courses/112/104/112104222/ Ergonomics workplace analysis https://nptel.ac.in/courses/107/103/107103085/
Learning Outcomes	On completion of the course student will be able to : **LO1:** Demonstrate ergonomic principles to the creation of safer, healthier and more efficient and effective activities in the workplace; **LO2:** Perform ergonomic risk assessments **LO3:** Design appropriate control measures for ergonomic risk factors

Goa University

Programme: B.C.A.
Course Code: CAG111 **Title of the Course:** Social Engineering
Number of Credits: 04 **Effective from AY:** 2020-21

Prerequisites	None
Objectives	The course aims to : **CO1.** Learn the Concepts of Social Engineering. **CO2.** Learn the importance of Social Engineering. **CO3.** Learn the types of Social Engineering Attacks. **CO4.** Learn Psychological principles used in Social Engineering. **CO5.** Learn Power of persuasion. **CO6.** Identify and prevent Social Engineering Attacks. **CO7.** Learn usage of tools of Social Engineering.

	Content	**No. of Hours (60)**
1	**Introduction of Social Engineering** Overview of social engineering, examples from the movies, famous social engineers, real-world attacks, summary	05
2	**Information gathering** Gathering information, Sources of Gathering information, Communication Modelling, the power of Communication Models.	04
3	**Social Engineering Attack** Types, Non-Technical Attack Vectors: Phishing, Spear Phishing, Vishing, Pretexting, Baiting, Spam mails, Popup video, Technical Attack Vectors: Pretexting/Impersonation , Dumpster diving, Spying and Eavesdropping, acting as a technical expert, Hoaxing.	07
4	**Elicitation** Concept of Elicitation, the Goals of Elicitation, Mastering Elicitation	07
5	**Mind Tricks: Psychological Principles Used in Social Engineering** Modes of Thinking, Micro expressions, Neuro linguistic Reprogramming(NLP), terview and Interrogation, Building instant Rapport, The Human Buffer Overflow	08
6	**Influence: The Power of Persuasion** The Five Fundamentals of Influence and Persuasion, Influence Tactics, Altering Reality: Framing Manipulation, Controlling your target, Manipulation in Social Engineering.	10
7	**The Tools of the Social Engineering** Physical Tools, Online-Information gathering tools	08
8	**Prevention and Mitigation** Learning to Identify Social Engineering Attacks, Creating a Personal Security Awareness Culture, Keeping Software Updated, Developing Scripts, Being Aware of the Value of the Information You Are Being asked For, Learning from Social	05

	Engineering Audits	
9	**Case Studies** Dissecting the Social Engineer, Mitnick Case Study 1: Hacking the DMV, Mitnick Case Study 2: Hacking the Social Security Administration, Hadnagy	06

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.
Textbooks/ Reference Books	**Textbooks:** 1. Christopher Hadnagy, Social Engineering: The Art of Human Hacking , WileyPublishing, 2010 2. William E. Drake, Education as social Engineering, Wiley Publishing **References:** 1. Dr. Erdal Ozkaya, Learn Social Engineering, Packt Publishing,2018 **NPTEL Resources** **Social Networks :** https://nptel.ac.in/courses/106/106/106106169/
Learning Outcomes	On completion of the course student will be able to : **LO1.** Explain the term Social Engineering. **LO2.** Identify the types of a Social Engineering attack. **LO3.** Choose tools for Social Engineering. **LO4.** Compare social engineering techniques on effectiveness. **LO5.** Explain techniques to prevent and mitigate Social Engineering attacks. **LO6.** Identify the possibility of downloading malicious software on unsuspecting user systems.

Goa University

Programme: BCA

Course Code: CAG112 **Title of the Course:** E-waste management

Number of Credits: 04 **Effective from AY**: 2020-2021

Prerequisites:	The students should have an understanding of different types of solid waste and its classifications.	
Objectives:	**In this course the student learns :** **CO1**: Knowledge of E-Waste Management in India and around the world. **CO2**: Awareness about the different methods of E-Waste Management. **CO3**: The effects of recycling and management of Electronic Waste on human health, environment and society **C04**: Role of E-Waste management within the various initiatives of the Govt. of India.	
Content:		**Number of Lectures**
Units	Topics	60
1	**Introduction to E-Waste:** • Definition • E-Waste Composition, • Sources and Classification of E-Waste. • E-waste generation in India and comparison with world scenario ; Facts & figures • State Wise E-Waste Generation (in Tonnes) in India • Sources of E-Waste in India • Case Studies **Hazards of Electronic Waste:** • Environmental and Health Hazards due to Improper Disposal of E-Waste • Health Risk Assessment • Case Studies	15
2	**Quantification Of E-Waste:** • Method of Estimation of E-Waste • Economic Assessment of E-Waste • Case Studies **E-waste management in India:** • Aims and Objectives of E-Waste Management in India. • Rules and Service Providers • Top E-Waste Management Companies In India • E-waste Management and Handling Rules and Guidelines – India Regulatory frameworks in India	15

3	**Global Generation of E-Waste:** • Transfers of E-waste from developed to developing country • Recent Technologies in E-Waste Management. **Resource Recovery from E-Waste:** • Recovery Of Metals From Electronic Waste • Life Cycle Assessment(LCA) Of Electronic Waste Treatment: LCA And Sustainable Engineering And Electrical And Electronics Industry; Application Of LCA In Designing Better Electronics. • Waste Electrical And Electronic Equipment (WEEE) • Pyrometallurgical Process • Hydroetallurgical Process • Bio-Metallurgical Process	15
4	**Importance of E-Waste Management** • Role of different stakeholders in Environment Management of Electronic Waste. • Producers, Consumers, Recyclers and Statutory Bodies. **Issues and Challenges of E waste Management**: at Regional, National International level. • Need for international Standards for Management of E-Waste. • Case Studies	15
Pedagogy	lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/Reference Books	**Textbooks:** 1. Hester R E(2018)Electronic Waste Management (Issues in Environmental Science and Technology, Royal Society of Chemistry. United Kingdom. 2.Prasad Majeti Narasimha Vara and Vithanage Meththika (2019), Electronic Waste Management and Treatment Technology,Butterworth-Heinemann Inc.USA. 3.Chatterjee Sandip (2010), Electronic Waste Management: An Indian Perspective, LAP Lambert Academic Publishing. 4. Fowler, Bruce A (2017), Electronic Waste, Academic Press, USA. 5. Eduljee G. H and Harrison R.M (2019) Electronic Waste Management (Issues in Environmental Science and Technology. Royal society of chemistry, United Kingdom. **Reference Books:** 1.Prasad Majeti Narasimha Vara ,Handbook of Electronic Waste Management: International Best Practices and Case Studies;' Butterworth-Heinemann Inc (22 November 2019) 2.Işildar Arda , Metal Recovery from Electronic Waste: Biological Versus Chemical Leaching for Recovery of Copper and Gold (IHE Delft PhD Thesis Series);' CRC Press; 1 edition (15 November 2018) 3.Pant , Deepak ,Electronic Waste Management;' LAP Lambert Academic Publishing (17 December 2010)	

	4. Blokdyk Gerardus. Electronic Waste E-Waste;' 5starcooks (16 August 2018) 5. Goodship Vannessa . Waste Electrical and Electronic Equipment (WEEE) Handbook (Woodhead Publishing Series in Electronic and Optical Materials) Woodhead Publishing; 1 edition (30 August 2012) 6. Hester R. E. Electronic Waste Management (Issues in Environmental Science and Technology). Royal Society of Chemistry; 1 edition (30 November 2008) 7. Taherzadeh Mohammad J. Resource Recovery to Approach Zero Municipal Waste (Green Chemistry and Chemical Engineering) CRC Press; 1 edition (18 October 2017) 8.Bandhopadhyay, A. (2010) "Electronic Waste Management: Indian Practices and Guidelines" International Journal of Energy and Environment 1(5) pp. 193-807 9.Erach Bharucha, 'Text book of Environmental Studies for undergraduate courses'; Universities Press (India) Private Limited, 2005 or later editions. 10.J. P. Sharma , 'Comprehensive Environmental Studies',Laxmi Publications (P) Ltd, latest edition. **NPTEL Resources** Electronic Waste Mangement - Issues and Challenges https://nptel.ac.in/courses/105/105/105105169/
Learning Outcomes	On completion of the course the student will be able to: **LO1**: Define the system of E-Waste Management and its functionality. **LO2**: Define the concept of E-Waste. **LO3**: Identify the sources, effects and approaches to deal with E-Waste. **LO5**: Describe the E-waste management system in India. **LO6**: Describe the techniques of e-waste assessment. **LO7**: Explain the knowledge about the scope, importance and challenges of e-waste management. **LO8**: Analyse the hazards of e-waste. **LO9**: Demonstrate basic skills to motivate and guide the common people to manage the E-waste for environmental conservation.

Goa University

Programme: B.C.A.

Course Code: CAG113 **Title of the Course:** Ethics & CSR

Number of Credits: 04 **Effective from AY:** 2020-21

Prerequisites	None		
Objectives	The course aims to : **CO1** Acquire knowledge of Ethics in the modern era **CO2** Understanding of Ethical decision making approaches **CO3** Understand the scope and complexity of Corporate Social responsibility in the global and Indian context.		
Content			**No. of Hours (60)**
1	**Basic Concepts in Ethics & Ethical Theories**	Introduction, Terminology, Personal Ethics, Professional Ethics, Life skills, Basic Ethical Principles, Moral Development, Theories-Piaget's Theory, Kohlberg's Theory, Elliot Turiel's Theory, Gilligan's Theory, Comparison of Moral Development Theories. Classification of Ethical Theories, Some basic Theories	10
2	**Global Issues in Ethics**	Introduction, Current Scenarios, Business Ethics, Environmental Ethics, Computer Ethics, Media Ethics, Bioethics, Research Ethics, Intellectual Property Rights, Professionals & Ethics.	10
3	**Ethical Codes**	Need for Ethical Codes, Sample codes, Codes from Other Professions, Corporate Codes, Implementation of codes, Limitations of codes.	10
4	**Ethics Audit & Ethical Living**	Need for Ethics audit, Ethics Profiles of Organizations, Considerations for Ethics Audit, Ethics standards and Benchmarking, Procedure for Ethics audit, Ethics audit Report, Ethical living for Professionals.	10
5	**Understanding Corporate Social Responsibility (CSR), Evolutions of Company & CSR Role of various institutions in CSR**	Introduction, Understanding CSR, History of CSR in India. Theories of corporate Governance, Importance of CSR in Corporate Governance, The Social Impact. Introduction, Role of Government, Role of NGO'S & Not-for-profit Organizations, Role of Educational Institutions, Role of the Media.	10
6	**Framework for rating CSR & Global CSR.**	Understanding CSR ratings, available Accepted Rating Frameworks, Structure of BITC CR Index, Rating Criteria and basic structure of the rating process. Study of Sample Rating Framework for Corporate Multinational companies,	**10**

		challenges of multinationals, country specific CSR Initiatives.	

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	Text Book : 1. A.C. Fernando , Business Ethics and Corporate Governance, Pearson, 2nd Edition Reference Books : 1. R.Subramanian , Professional Ethics, Oxford Higher Education. 2. Madhumita Chatterji , Corporate Social Responsibility, Oxford Higher Education 3. Fernando , Corporate Ethics, Governance, and Social Responsibility: Precepts and Practices, Pearson **NPTEL resources** Ethics : https://nptel.ac.in/courses/109/106/109106117/ Corporate Social Responsibility : https://nptel.ac.in/courses/110/105/110105081/
Learning Outcomes	On completion of the course, the student will be able to **:** **LO1** Understand ethical theories and ethics in profession. **LO2** Analyze global issues in ethics **LO3** Apply Ethical Code, Audit and living in real world **LO4** Analyze Corporate Social Responsibility and its framework

Goa University

Programme: B.C.A.

Course Code: CAG114

Title of the Course: Business Infrastructure and Management

Number of Credits: 04 **Effective from AY:** 2020-21

Prerequisites	None
Objectives	**The course aims to :** **CO1** Study fundamentals of conducting business over the Internet. **CO2** Familiarize with the Infrastructure, Ethics of Electronic-business **CO3** Explore different kinds of business values and managing the change in digital market

	Content		**No. of Hours (60)**
1	**The world of E–Business**	What Is E-Business?, Characteristics Of E-Business, Categories Of E-Business (B2B, C2B, B2C, C2C), Elements Of E-Business, E-Business Roles And Challenges, E-Business Requirements, Impact Of E-Business, Inhibitors Of E-Business.	06
2	**E-business Strategies**	What Is E-Business Strategies, Strategic Positioning, Levels Of E-Business Strategies, The Changing Competitive Agenda: Business And Technology Drivers, The Strategic Planning Process, Strategic Alignment, The Consequences Of E-Business: Theoretical Foundations, Success Factors For Implementation Of E-Business Strategies.	06
3	**E-Business Models**	Pressure Forcing Business Changes, Business Models – Definition, Classification Of Business Models, Networked Business Models.	06
4	**The digital firm – Electronic business / Electronic Commerce**	**Electronic Business, Electronic Commerce And The Emerging Digital Firm:** Internet Technology And The Digital Firm, New Business Models & Value Propositions **Electronic Commerce:** Categories Of Electronic Commerce, Customer – Centered Retailing, **Windows On Management:** Customer Communities Become Product Development Tools, B2B Electronic Commerce, New – Efficiencies And Relationships, **Window On Organization:** Covisint: The Vision And The Reality, E – Commerce Payment Systems. **Electronic Business & The Digital Firm:** How Intranets Support Electronic Business, Intranets & Group Collaboration,	12

		Intranet Applications For E – Business, Supply Chain Management & Collaborative Commerce. **Management Challenges And Opportunities:** Unproven Business Models, Business Process Change Requirements, Legal Issues, Trust, Security & Privacy, MIS In Action: Manager's Toolkit: Digitally Enabling The Enterprise: Top Questions To Ask, Make IT Your Business.	
5	**Digital / Electronic Markets & Solutions**	Electronic Markets Defined, Functions Of Electronic Markets, How Do Electronic Markets Differ From Traditional Market?, Effects Of Electronic Markets, Electronic Market Success Factors, E-Market Technology Solutions.	08
6	**E-Business technological Infrastructure and Management**	Technical e-Business Challenges, Basic Infrastructure, Web Technologies and Application, Collaborative Technology, The role of enterprise Information Systems in e-Business. **The new IT Infrastructure for the Digital Firm:** Enterprise Networking and Internetworking, Standards and connectivity for the Digital Integration, Technology and Business Standards. **Support Technology for Electronic Business:** Web Server and Electronic Commerce servers, How to Integrate the wireless Web into Business strategy, Customer Tracking and Personalization Tools, Web content Management Tools, Web site Performance Monitoring Tools, Web Hosting Services, The Challenge of Managing the IT Infrastructure and Solutions.	12
7	**Ethical & Social Issues in the digital firm**	**Understanding ethical and social issues related to systems:** Model For Thinking About Ethical, Social And Political Issue, Moral Dimensions Of The Information Age, Key Technology Trends That Raise Ethical Issue. **Ethics in An information society:** Basic Concepts: Responsibility, Accountability And Liability, MIS In Actions: Manager's Toolkit: How To Conduct An Ethical Analysis, Candidate Ethical Principles, Professional Codes Of Conduct, Some Real World Ethical Dilemmas. **The moral dimensions of information Systems:** Information Rights: Privacy & Freedom In The Internet Age, **Window On Organizations:** Privacy For Sale, Property Rights: Intellectual Property, Accountability, Liability And Control, System Quality: Data Quality And System Errors, Quality Of Life: Equity, Access And Boundaries, **Window On Management:** Alberta Narrows Its Digital Divide, Management Actions: Corporate Code Of Ethics Make IT Your Business.	10
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	Text Book : 1. Michael P. Papazoglou , Pieter M.A. Ribbers, E-Business Organizational and Technical Foundations, Wiley India Edition. Reference Books : 1. Waman S Jawadekar, Management Information Systems- A Digital-Firm perspective ,4th edition,TMH 2. Kenneth C Laudon, Jane P.Laudon Managing The Digital Firm , , Pearson Education, Eighth Edition
Learning Outcomes	On completion of the course, the student will be able to **:** LO1 Describe transformation of traditional business into an e-business. LO2 Identify the Infrastructure and Security issues related to e-business LO3 Explain the current scenarios of digital world and applications of it

Goa University

Programme: B.C.A.

Course Code: CAG115 **Title of the Course:** Information Security

Number of Credits: 04 **Effective from AY:** 2020-21

Prerequisites	None
Objectives	The course aims to **:** **CO1** Learn information assurance as practiced in computer operating systems, distributed systems, networks and representative applications. **CO2** Learn cryptography and key encryption techniques used today. **CO3** Comprehend relevant security parameters in the internet, web, database systems and applications

	Content		**No. of Hours (60)**
1	**Introduction**	Principles of Security, Attacks, Services and Mechanisms, Integrity check, digital Signature, authentication.	04
2	**Cryptography**	Private Key Cryptography: Block Encryption, DES Algorithm, Problems with DES, Variations of DES, IDEA Algorithm, Uses of Secret key Cryptography; ECB, CBC, OFB, CFB Public Key Encryption : RSA Symmetric and Asymmetric Key Cryptography together	10
3	**Authentication**	Types of Authentication- Password-based authentication, address-based authentication, cryptographic authentication, smart cards, biometrics, mutual authentications, reflection attacks, Message Digest : MD5 ,SHA,MAC ,HMAC, Digital Certificate process, KDC-working, multi domain KDC, Kerberos	10
4	**Internet Security**	Transport Layer Security: SSL, SET Email Security : PGP, S/MIME, Comparison, IP security : IPSec, Web Services Security : XML, SOAP, WSDL and UDDI, SSl, WS-Security, SAML, Ws-Trust, WS-Security Policy	10
5	**Intrusion Prevention And Detection**	Introduction, Intrusion Detection Systems , Prevention versus Detection, Types of Intrusion Detection systems, DOS attacks, Flooding Attacks, DdoS Attack Prevention/Detection, Defences Against Denial-of-Service Attacks, Malware Detection	06
6	**Database Security**	The Need for Database Security, Database Access Control, Inference, Statistical Databases , Database Encryption,	08
7	**Firewalls**	Characteristics, Packet filters, Application Level Gateways, Circuit Level Gateways, Firewall Architectures, Trusted System	06
8	**IEEE 802.11 Wireless LAN**	Background, Authentication: Pre-WEP Authentication, Authentication in WEP, Authentication and key agreement	06

	Security	in 802.11i, Confidentiality and Integrity: Data protection in WEP, Data protection in TKIP and CCMP	

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	**Text Book :** 1. Atul Kahate, Cryptography and Network Security, McGraw Hill **Reference Books :** 1. Bernard Menezes , Network Security sand Cryptography, CENGAGE Learning 2. V. K. Pachghare , Cryptography and Information Security, PHI Learning Pvt. Ltd. **NPTEL Resources** Information Security : https://nptel.ac.in/courses/106/106/106106129/
Learning Outcomes	**On completion of the course the student will be able to :** **LO1** Describe the requirement of information security and a clear understanding of its importance **LO2** Describe information security threats and countermeasures, and with information security designs using available secure solutions **LO3** Describe database security mechanisms, intrusion detection systems, formal models of security, cryptography, network ,web security

Goa University

Programme: B.C.A.

Course Code: CAG116

Title of the Course: Decision Making and Mathematical Modelling

Number of Credits: 04 **Effective from AY:** 2020-21

Prerequisites	None		
Objectives	The course aims : **CO1** To Understand the fundamental ideas of Discrete Mathematics **CO2** To Express the decision making concepts as a mathematical model **CO3** To Study and identify a real life business problem and computing requirements appropriate to its solution		
Content			**No. of Hours (60)**
1	**Mathematical Logic**	Propositions and logical operations, Conditional Statements, Methods of Proof , Mathematical Induction, Mathematical Statements , Logic and Problem Solving, Normal Forms	8
2	**Sets and Relations**	Set operations and functions, Product sets and partitions, Relations and digraphs, Paths in Relations and Digraphs, Properties of Relations , Equivalence Relations, Operations on Relations, Partially Orders Sets, Hasse diagram	10
3	**Graphs**	Graph, Representation of Graph, Adjacency matrix, Adjacency list, Euler paths and Circuits, Hamiltonian Paths and Circuits	8
4	**Mathematical Models**	Mathematical Models - Vehicular Stopping Distance Modelling using decision theory : Probability and Expected Value (e.g. Rolling the Dice, Life Insurance, Roulette etc) Decision Trees , Classification problems using Bay's Theorem	8
5	**Modelling using difference equation**	Recurrence relation - Fibonacci series, Tower of Hanoi ,Lines in a plane Homogenous linear equations with constant coefficients, Particular Solution, Total Solution, Divide and Conquer Recurrence Relations (Fast Multiplication of Integers, Fast matrix Multiplication)	12
6	**Characteristics Of Complex Business Problems**	Number of Possible Solutions, Time-Changing Environment, Problem-Specific Constraints, Multi-objective Problems, Modelling the Problem A Real-World Examples,	6
7	**MADM & MCDM**	Introduction to Multiple Attribute Decision-making (MADM) Multiple Attribute Decision-making Methods, Simple Additive Weighting (SAW) Method, Weighted Product Method (WPM), Analytic Hierarchy Process (AHP) Method, Entropy Method, Compromise Ranking Method (VIKOR), Weighted Average Method (WAM) Introduction to Multiple Criteria Decision Making (MCDM)	**8**
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 are achieved.
Textbooks/ Reference Books	Text Book : 1. Kenneth H. Rosen , Discrete Mathematics and Its Applications, McGraw Hill, 4th Edition Reference Books : 1. A First Course in Mathematical Modeling 5th Edition, Frank R. Giordano, William P. Fox, Steven B. Horton 2. Adaptive Business Intelligence,F 1st Edition by Zbigniew Michalewicz, Martin Schmidt, Matthew Michalewicz, ConstantinChiriac, Springer Publication 3. Decision Making in the Manufacturing Environment Using Graph Theory and Fuzzy Multiple Attribute Decision Making Methods,1st Edition by R. VenkataRao, Springer Publication 4. Discrete Mathematical structures 4th Edition, Kolman, Busby, Ross, PHI **NPTEL Resources** Decision Modeling : https://nptel.ac.in/courses/110/105/110105082/
Learning Outcomes	On completion of the course the student will be able to : **LO1** Develop mathematical and logical thinking **LO2** Model situations from variety of settings in generalised mathematical form **LO3** Solve the real world business problem

Goa University

Programme: B.C.A.

Course Code: CAG117 **Title of the Course: IT in Management**

Number of Credits: 04 **Effective from AY:** 2020-21

Prerequisites	None
Objectives	The course aims to : **CO1** Understand Information Technology and its practices in managing the business **CO2** Conceptualize the process of Technology acquisition in an Industry **CO3** Familiar with impact and issues of Information Technology for managing business operations with social concern.

	Content		**No. of Hours (60)**
1	**Information Technology Support and Application**	Introduction to Information Technology, Business Values Of IT, Role Of Computer in Modern Business, Current Trends, Business in Digital Economy.	**8**
2	**Information System And business applications**	Introduction to Information System: Information System, Classification and type of Information System, Information system Infrastructure and architecture, Role of Information systems in Business Today, Perspective on Information systems, Software and hardware platform to Improve Business Performance, Management opportunities challenges and Solutions, Business applications: Roles of IT in E-commerce, M-commerce.	**8**
3	**Acquisition of Information Technology**	Need to acquire technology, developing new technologies, Increasing strategic options, Gaining efficiency improvements, sources for acquiring technology, Responding to the competitive environment.	**8**
4	**Impact of Information Technology on organization and Strategic Issues of Information Technology**	Impact of Information Technology on organization : Modern Organizations ,Creating New Types of Organizations Strategic Issues of Information Technology: Information Technology and Corporate Strategy, Creating and Sustaining a Competitive Edge, Integrating Technology with the Business Environment, Managing Information Technology	**8**
5	**IT for managing International business and Governance**	International Business and IT technologies: International Business Strategies, Key Issues in International Environment, Managing IT Internationally. Governance concept: IT Governance, Internet governance, E-governance and internal IT processes.	**12**
6	**Information Technology**	Management in a Technological Environment, The Changing World of Information Action Plan	**8**

	Issues For Management		
7	**Societal Implications And The Future With Technology**	Social Responsibilities, Ethics and Information Technology, The Future with Information Technology	**8**
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 are achieved.	
Textbooks/ Reference Books		Text Book : 1. Henry C. Lucas, Information technology for Management, Mc**Graw Hill Publications,** 7th Edition Reference Books : 1. Information Technology For Management – Transforming Organizations in Digital Economy by EFRAIM Turban, Dorothy Leidner (WILEY Student Edition) 2. Information Technology For Management by B. MuthuKumaran (OXFORD University Press) 3. Information Technology For Management by Dr. CH. Seetha Ram. 4. Technology Acquisition ,A guided approach to technology acquisition and protection decision by Mortara and Ford. 5. Business Intelligence: Practices, Technologies, and Management- Rajiv Sabherwal, Irma Becerra-Fernandez 6. Managing and using Information Systems, K E Pearlson, C S Saunders, Wiley India	
Learning Outcomes		**LO1** To use various IT tools used for managing the Industrial operation. **LO2** To apply the decision for selecting the proper IT tools for Management operation. **LO3** To design the strategic plan for using Information Technology in Management	

Goa University

Programme: B.C.A.

Course Code: CAG118**Title of the Course:** Data Mining and Business Intelligence

Number of Credits: 04 **Effective from AY:** 2020-21

Prerequisites		None	
Objectives		The course aims to : **CO1** Acquire the knowledge of various concepts and tools behind data warehousing and mining data for business intelligence **CO2** Study data mining algorithms, methods and tools **CO3** Identify business applications of data mining	
Content			**No. of Hours (60)**
1	**Introduction to Data Mining and Pre-processing**	Data mining- definition and functionalities, KDD Process, Data Cleaning: - Missing values, Noisy data, data integration and Transformations. Data Reduction: - Data cube aggregation, dimensionality reduction- data compression, Numerosity reduction- discretization and concept hierarchy.	08
2	**Associations Rule mining**	Association rule mining:-support and confidence and frequent item sets, market basket analysis, Apriori algorithm, Incremental ARM, Associative classification- Rule Mining.	08
3	**Classification and Prediction**	Introduction, Classification methods:-Decision Tree- ID3, CART, Bayesian classification- Baye's theorem (Naïve Bayesian classification),Linear and nonlinear regression.	08
4	**Clustering**	Introduction, categorization of Major, Clustering Methods:- partitioning methods- K-Means. Hierarchical- Agglomerative and divisive methods, Model- based- Expectation and Maximization.	08
5	**Web mining and Text mining**	Text data analysis and Information retrieval, text retrieval methods, dimensionality reduction for text.Web Mining: - web content, web structure, web usage.	06
6	**Business Intelligence-**	Introduction and overview of BI-Effective and timely decisions, Data Information and knowledge, BI Architecture, Ethics and BI. BI Applications- Balanced score card, Fraud detection, Telecommunication Industry, Banking and finance, Market segmentation.	06
7	**Prediction methods and models for BI**	Data preparation, Prediction methods-Mathematical method, Distance methods, Logic method, heuristic method-local optimization technique, stochastic hill climber, evaluation of models	08
8	**BI using Data Warehousing**	Introduction to DW, DW architecture, ETL Process, Top-down and bottom-up approaches, characteristics and benefits of data mart, Difference between OLAP and OLTP. Dimensional analysis- Define cubes. Drill- down and roll- up – slice and dice or rotation, OLAP models- ROLAP and MOLAP. Define Schemas- Star, snowflake and fact constellations.	08
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 are achieved.
Textbooks/ Reference Books	**Reference Books** : 1. Carlo Vercellis , Business Intelligence Data Mining and optimization for Decision Making ,wiley publication. 2. Zbigniew Michalewicz , Adaptive business Intelligence , Springer 3. Jiawei Han and Micheline Kamber, Data Mining concepts and techniques, Morgan Kauffman, Third edition 4. M.Dunham , Data Mining:" Introductory and Advanced topics" , Pearson Education 5. Paulraj Ponnian , Data warehousing Fundamentals by, John Willey **NPTEL Resources** Data Mining : https://nptel.ac.in/courses/106/105/106105174/
Learning Outcomes	On completion of the course the student will be able to : **LO1** Use conceptualization of BI techniques **LO2** Apply data warehouse concepts for data analysis and report generation **LO3** Develop industry level data mining skills using software tools **LO4** Make use of relevant theories, concepts and techniques to solve real-world BI problems

Goa University

Programme: B.C.A.

Course Code: CAG119 **Title of the Course:** Micro Economics

Number of Credits: 04 **Effective from AY:** 2020-21

Prerequisites:	None	
Objectives:	The course aims to : CO1. Introduce the basic concepts of economics CO2. To develop an understanding on Utility analysis Indifference curve analysis. CO3. To learn and understand the various factors of production in detail.	
Content		**No. of Hours (60)**
1	**Introduction to Economics** Definitions of Economics – Wealth, welfare and scarcity – subject matter and scope of Economics – Micro and Macro approach – Deductive and inductive methods – positive and normative – Static and dynamic – partial and general equilibrium.	10
2	**Utility Analysis** – characteristics of wants – Law of diminishing Marginal utility, Law of equi-marginal utility – Theory of demand – Elasticity of demand – consumer's surplus.	08
3	**Indifference Curve Analysis** – income effect, price effect and substitution effect – derivation of demand curve – Indifference curve Vs Marshallian utility analysis Samuelson's Revealed preference theory.	08
4	**Factors of production** - Land, Labour, Capital and organization – laws of Returns – Returns to scale – production Function.	07
5	**Cost concepts** – total, average and marginal cot – short run and long run costs – Law of supply.	06
6	**Market structure** – perfect competition – Monopoly – Discriminating monopoly – degrees of monopoly – dumping – control of monopoly.	07
7	**Wages and Rent** Distribution –Marginal productivity theory –Modern theory of distribution – Theories of wages –Trade Union and Collective bargaining. Rent –Ricardian Theory –Modern theory –Quasirent	07
8	**Interest and Profit** Interest –Theories of Interest classical, neo-classical and Keynesian Theory. Profit –Concepts –Theories of Profit	07
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.
Text Book/ Reference Books	**Text Book:** 1. Agarwal, H.S., Advanced Economic Theory, Konark Publishers Pvt Ltd. **Reference Books :** 1. H.L. Ahuja, Principles of Micro Economics, S Chand, 2016. 2. Jhinghan, M.L., Advanced Economic Theory, Vrinda Publications P. Ltd., Fourteenth Edition. 3. R. Cauvery, Micro Economic Theory, S.Chand (G/L) & Company Ltd. 4. K.K.Dewett , Modern Economic Theory, S Chand & Co Ltd, 2014 Revised Edition. **NPTEL Resources** Microeconomics- Theory and Applications : https://nptel.ac.in/courses/110/104/110104093/
Learning Outcomes:	On completion of the course, the student will be able to LO1: Explain the basic concepts of economics. LO2: Explain Utility analysis and Indifference curve analysis. LO3: Compare the various factors of production in detail.

Goa University

Programme: B.C.A.

Course Code: CAG120 **Title of the Course:** Monetary Economics

Number of Credits: 04 **Effective from AY:** 2020-21

Prerequisites:	None
Objectives:	CO1. To learn & understand the Role and Functions of Money. CO2. To learn & understand various Monetary Theories. CO3. To learn & understand the concepts of Inflation and Deflation. CO4. To understand the framework of Banking. CO5. To understand the Monetary Policy. CO6. To understand the role of RBI as the apex financial regulatory body. CO7. To understand the exchange rates in global transactions.

	Content	**No. of Hours (60)**
1	**Introduction to Money** Evolution, Role and Functions of Money – Gold Standard – Types – Working of the Gold standard – causes for the down fall of the Gold standard – paper currency standard. Paper currency – system of Note issue – Indian currency system Development and problems.	12
2	**Monetary Theories** Quantity Theory of money Fisher and Cambridge Keynes theory of money and Prices Milton Friedman –Restatement of quantity Theory. Concepts of supply and demand for money – money supply and price level – Keynes – classical Dichotomy – Real Balance Effect.	10
3	I**nflation and Deflation** Inflation – Types – causes – effects and Remedies – Deflation – Trade cycle – phases of trade cycle - Causes.	06
4	**Banking** Functions and types of commercial banking – balance sheet – credit creation – Investment policy in commercial Banking. Progress of Indian Banking during post nationalization period – development banks, DBI, IFCI, ICICI – other term financing Institutions in India.	12
5	**Monetary Policy** Monetary policy – Indian money market organized unorganized functions of Capital market, credit control quantitative and qualitative methods – limitations.	08
6	**Reserve Bank of India** Reserve Bank of India –Functions –credit control –Rural and Industrial credit – Exchange control.	06
7	**Exchange Rates** Exchange rate – Fixed and Flexible – problems of international liquidity – IMF Functions – SDR – IBRD, GATT – WTO.	06

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.
Text Books	T**ext Book** 1. Mithani D., Money Banking and International Trade and Public Finance, Himalaya Publishing House, Twentieth Revised Edition. 2. Vaish.M.C, Monetary Theory, Vikas Publishing House Pvt Ltd; Sixteenth Edition. **Reference Book** 1. Sundharam K.P.M. , Monetary Theory and practices, PHI Learning, New Delhi. 2. Narayanan Nadar, Money and Banking, PHI Learning, New Delhi. 3. M.L.Seth, Money Banking and International Trade and Public Finance, Lakshmi Narian Agarwal; First Edition, 2017. 4. Dr.Cauvery, Monetary Economics, S Chand & Company, 2010. 5. R Parameswaran, Indian Banking, S Chand, 2010. 6. Dr. Satish Kumar Saha, Money & Banking, SBPD Publications, First Edition, 2014. 7. Steven Durlauf, L. Blume - Monetary Economics, Palgrave Macmillan UK, Second Edition, 2010.
Learning Outcomes:	On completion of the course, the student will be able to **LO1.** Understand the Role and Functions of Money. **LO2.** Understand various Monetary Theories. **LO3.** Understand the concepts of Inflation and Deflation. **LO4.** Understand the framework of Banking. **LO5.** Understand the Monetary Policy. **LO6.** Understand the role of RBI as the apex financial regulatory body. **LO7.** Understand the exchange rates in global transactions.

Goa University

Programme: B.C.A.
Course Code: CAG121 **Title of the Course:** Digital Marketing
Number of Credits: 04 **Effective from AY:** 2020-21

Prerequisites	None
Objectives	**CO1.** To acquaint the students with basic principles and concepts of digital marketing & advertising **CO2.** To understand and familiarize the students with the concept of Digital Marketing techniques like Adwords, search advertising, display advertising. **CO3.** To understand the concept of Search Engine Optimization (SEO)

	Content	**No. of Hours (60)**
1	**Fundamentals of Digital Marketing** Marketing in the digital world; Integrated marketing- The Phygital; Global trends in Digital Marketing; Digital channels- Paid, Owned and Earn; Fundamentals on the primary asset- your website; Careers in digital marketing; Skill development in digital marketing	**05**
2	**AdWords Fundamentals** Understanding Pay-per-click Advertisement; Significance and evolution of AdWords in PPC Bing Ads V/s Google Ads- overview; AdWords Certification- Overview, Benefits and Preparation; Google Ad Networks; Different Ad Formats; Keywords - significance and planning; Using Keyword Planner and other tools; Keyword matches and their usage; Campaign Structure and Organisation Quality, Rank and Relevance of Ads; Bidding and budget; Targeting Setting Extensions and their usage; Ad policies and approvals; Reports and Analysis Metrics; Conversion Tracking; Campaign Optimisation	**10**
3	**Search & Display Advertising with Adwords** **Search with Adwords** Keywords - planning, matching and combination; Specifications of an Ad and how to put it to good use; Managing Invalid Clicks; Ad extensions and usage; Dynamic search ads; Landing page - your virtual front; Campaign Experiment; Opportunities Tab; AdWords APIs; AdWords editor- Benefits and usage; Managing multiple accounts **Display with Adwords** Google Display Network and Partnerships; Double Click Ad Exchange and AdSense Campaign Creation and Structuring for display; Keyword and targeting through display network; Campaign Metrics, Analysis and optimization	**15**

4	**SEO Basics** How search engines work; Different Search results and significance; Query types and significance; What is SEO and key factors determining the same; Components on SEO - onsite and off page; Keyword Planning; Using tools to get effective keywords; Long tail keywords - the hidden gems; Art and science of tags - URL, title, meta, H1, alt text, etc.; Write a good meta description; Page speed - its impact and improvement areas; All about links - broken, internal et al; Dealing with duplicate content; Robot.txt and Sitemap; Structured data and schema.org	**15**
5	**SEO Advance Concepts** Link building basics; Avoiding harmful links; Finding and leveraging link building opportunities; Creating a link building plan; Major Google updates and their implications on SEO; Using Search Console for SEO; KPIs of SEO; Tools for SEO; Moz SEO Products; SEMrush Competitive Research and Business Intelligence Software; Competition Analysis for SEO; Overall planning for SEO; Understanding nuances of local and international SEO; Accelerated mobile pages and SEO; Artificial Intelligence, Voice search and SEO – what to look forward	**15**

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 concepts may be appreciated through practical and hands-on sessions as part of course delivery plan and assessment.
Text Books / Reference Books	**Recommended Reference Books:** 1. Dave Chaffey & Fiona Ellis-Chadwick, Digital Marketing: Strategy, Implementation and Practice, Pearson Education 2. Ekaterina Walter, The Power of Visual Storytelling, McGraw-Hill Education 3. Ben Hunt, Convert!: Designing Websites For Traffic and Conversions, John Wiley & Sons 4. Lon Safko, The Social Media Bible: Tactics, Tools, & Strategies for Business Success, Brilliance Audio; Unabridged edition 5. Pam Didner, Global Content Marketing, McGraw-Hill Education 6. Joe Pulizzi, Content Inc.: How Entrepreneurs Use Content to Build Massive Audiences and Create Radically Successful Businesses, McGraw-Hill Education

	7. Mike Monteiro, You're My Favorite Client, A Book Apart 8. Seth Godin, All Marketers Are Liars, Portfolio 9. Jay Baer, Youtility: Why Smart Marketing Is About Help Not Hype, Portfolio 10. Russell Glass & Sean Callahan, The Big Data-Driven Business, Wiley 11. Damian Ryan and Calvin Jones, Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation, Kogan Page 12. Ryan Deiss and Russ Henneberry, Digital Marketing for Dummies, John Wiley and Sons 13. Corey Rabazinski, Google Adwords for Beginners: A Do-It-Yourself Guide to PPC Advertising, CreateSpace Independent Publishing Platform
Learning Outcomes:	On completion of the course student will be able to **LO1.** Apply the understanding of digital landscape and building a case to leverage online channels **LO2.** Strategize, implement and optimize online campaigns successfully **LO3.** Develop and design Online Advertising campaigns, AdWords Campaign management and Campaign Basics across search. **LO4.** Drive organic traffic through Search Engine Optimization **LO5.** Apply advance concept of Search Engine Optimization to capture the right intent

Goa University

Programme: B.C.A.

Course Code: CAG122 **Title of the Course:** Social Media Marketing & Analytics

Number of Credits: 04 **Effective from AY:** 2020-21

Prerequisites:	None
Objectives:	The course aims to **CO1.** To understand the concept of Social Media Marketing platform. **CO2.** To have understanding of video and mobile platform advertising. **CO3.** To understand and apply the concept of web and google analytics. **CO4.** To acquire understanding of Linkedin, Twitter, Pintrest Marketing **CO5.** To Measure, Analyze and Optimize Social Media Marketing Campaigns **CO6.** To create an effective Digital Marketing Plan.

	Content	**No. of Hours (60)**
1	Introduction to Social Media Marketing Evolution and importance of Social Media; What social media can do for you?; Different social media platforms; Unwritten rules of Social Media; Facebook for business; Using of Facebook groups, pages and events; Using of Facebook tabs and apps; Running Facebook ads; Ad Manager and Power Editor in Facebook; Targeting – the structured approach; Facebook page Insights	**15**
2	You Tube Video and Mobile Advertising YouTube - why you need to be there?; YouTube format, tools & targeting; Video Campaign Creation; Video Campaign tracking and optimization; Video Ad performance & best practices; You Tube Analytics. Importance of Mobile and Opportunities to Leverage; Key Objectives for Mobile Marketing; Ad Formats and Networks for Mobile; Mobile Site: Key Considerations; Mobile App: Key Considerations; Mobile specific bidding and targeting; Apps Marketing, Mobile Analytics, Reporting and Optimization	**10**
3	**Media Marketing with Twitter, LinkedIn, Instagram & Snapchat** Introduction to Twitter and its terminologies; Creating a good Twitter profile; Building followers on Twitter; Using Twitter Chats; Twitter as an influencer marketing tool; Twitter ads; Twitter Analytics; LinkedIn for Business; Profile, pages and Pulse in LinkedIn; LinkedIn Ad; LinkedIn Analytics; B2B marketing using LinkedIn; Introduction to Pinterest for Business; Pinterest strategies; Instagram for business; Instagram strategies; New kid on the block – Snapchat; Online Reputation Management; Social media tools and how to use them; Creating social media calendar and workflow	**15**

4	**Web Analytics** Introduction to web analytics; How web analytics work; Analytics Framework; Goals, Objectives and KPIs; Contextualizing of Data; Segmentation of Data; Making analytics actionable; Attribution Modelling; URL tracking and UTM builder; Click stream, Heat Map and other forms of Web Analytics; A/B testing	**10**
5	**Google Analytics** How Google Analytics (GA) work; Dimensions, metrics and other common terminologies; Setting up Google analytics; Tracking, Reports and Dashboards; Acquisition, Behaviour and Conversion; Visitors Analysis; Source and Medium analysis; Conversion tracking; Content Performance Analytics; User flow; Leveraging real time analytics; Content Experiment; Linking Search Console and AdWords with Google Analytics; Intro to Google Data Studio	**10**

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 concepts may be appreciated through practical and hands-on sessions as part of course delivery plan and assessment.
Text Books / Reference Books	Recommended Reference Books: 1. Dave Chaffey & Fiona Ellis-Chadwick, Digital Marketing: Strategy, Implementation and Practice, Pearson Education 2. Ekaterina Walter, Jessica Gioglio ; The Power of Visual Storytelling : How to Use Visuals, Videos, and Social Media to Market Your Brand ,Mc Graw-Hill Education 3. Ben Hunt, Convert!: Designing Websites For Traffic and Conversions, John Wiley & Sons 4. Lon Safko, The Social Media Bible: Tactics, Tools, & Strategies for Business Success, Brilliance Audio; Unabridged edition 5. Pam Didner, Global Content Marketing, McGraw-Hill Education 6. Joe Pulizzi, Content Inc.: How Entrepreneurs Use Content to Build Massive Audiences and Create Radically Successful Businesses, McGraw-Hill Education 7. Mike Monteiro, You're My Favorite Client, A Book Apart 8. Seth Godin, All Marketers Are Liars, Portfolio 9. Jay Baer, Youtility: Why Smart Marketing Is About Help Not Hype, Portfolio 10. Russell Glass & Sean Callahan, The Big Data-Driven Business, Wiley 11. Damian Ryan and Calvin Jones, Understanding Digital Marketing:

	Marketing Strategies for Engaging the Digital Generation, Kogan Page 12. Ryan Deiss and Russ Henneberry, Digital Marketing for Dummies, John Wiley and Sons 13. Corey Rabazinski, Google Adwords for Beginners: A Do-It-Yourself Guide to PPC Advertising, CreateSpace Independent Publishing Platform
Learning Outcomes:	On completion of the course student will LO1. Have understanding of Social Media Marketing. LO2. Able to use mobile and video media for online advertising, & AdWords campaign management. LO3. Able to use Twitter, LinkedIn, Instagram & similar media for promotion. LO4. Comfortably apply relevant tools and concepts to execute measure and monitor an annual online marketing plan and use analytics to drive actionable improvements LO5. Use new digital marketing techniques into strategic marketing plan

Goa University

Programme: B.C.A.

Course Code: CAG**123** **Title of the Course:** Investment & Portfolio Management

Number of Credits: 04 **Effective from AY:** 2020-21

Prerequisites	None
Objectives	The course aims to : **CO1.** To understand the basics investment, security and security market. **CO2.** To understand new issue and secondary market of investment **CO3.** To understand the framework of investment alternatives, analyses and valuation. **CO4.** To know the basics of portfolio construction and management

	Content	**No. of Hours (60)**
1	**Introduction To Investments & Securities** **Investment** Meaning , Differentiation, speculation, gambling, investment , Investment objectives , Investment process **Securities** Equity, Equity shares , Sweat equity, non-voting shares ,Commutative preference shares, Non commutative preference shares, Convertible preference shares, Redeemable preference shares, Irredeemable preference shares, Cumulative convertible preference share, Debentures ,Types of debenture bonds , Types of bonds , Warrants	15
2	**New Issue & Secondary Market** **New Issue Market** Meaning , Parties involved in new issue market, Features, SEBI: Securities exchange board of India, Investor protection ,Regulators **Secondary Market** History of stock exchanges in India , Functions of stock exchanges and regulatory framework , Online trading NSE and BSE and regional stock exchanges	15
3	**Portfolio Construction** Approaches in portfolio construction , Determination of objectives , Selection of portfolio, Simple diversification ,Type of risk, Risk and return analysis	20

4	**Portfolio evaluation & revision** **Mutual fund** Sharpe , Treynor , Jensen ratio **Portfolio revision** Passive management , Active management	10

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 & evaluating of portfolio as a group activity.
Text Books / Reference Books	**Recommended Reference Books:** 1. C.P. Jones, Investments analysis and management, Wiley 2. Prasana Chandra, Investment analysis and Portfolio Management, McGraw Hill Education; Fifth edition 3. R.P Rustogi, Fundamentals of investment, Sultan Chand and Sons, New Delhi 4. Donald E. Fisher and Ronald J. Jordan: Security Analysis and Portfolio Management, Pearson Education, 6th Edition 5. Punithavathy Pandian , Security Analysis and Portfolio Management, Vikas Publisher House Pvt. Ltd., 2nd Edition **NPTEL Resources** Security Analysis and Portfolio Management : https://nptel.ac.in/courses/110/105/110105036/
Learning Outcomes:	On completion of the course student will **LO1.** Have basic understanding of investment, security and security market. **LO2.** Comfortably understand the framework of new issue and secondary market. **LO3.** Identify the reasons why people/companies/countries invest in securities. **LO4.** Identify how to measure the performance (risk/return) of securities. **LO5.** Apply the understanding to construct, analyze and manage basic portfolio

Goa University

Programme: B.C.A.

Course Code: CAG124 **Title of the Course:** General Insurance

Number of Credits: 04 **Effective from AY:** 2020-21

Prerequisites	None
Objectives	The course aims : **CO1.** To learn & understand the Concepts of Insurance business. **CO2.** To learn & understand the constitution of IRDA Act. **CO3.** To learn & understand the different types of insurance \ **CO4.** To know about emerging concepts in insurance industry.

	Content	**No. of Hours (60)**
1	I**ntroduction To Insurance Business** **Insurance terminology** Meaning, Definition, Objective, Evolution of Insurance in India, Insurance contract, Functions and importance of Insurance, Principles of Insurance, Difference between Life and General Insurance, Role of Insurance in economic development, Benefits of Insurance to society	15
2	**Insurance Legislative and Regulatory Matters** **Insurance Regulatory & Development Authority (IRDA) Act 1999** Constitution of IRDA, Objectives, Functions, Duties and power of regulators **Insurance Act 1938** **General insurance business Act 1972** Nationalization Amendment Act, Government schemes for insurance, Pradhan Mantri Suraksha BhimaYojana (PMSBY), financialservices.gov.in/insurance-divisions GOI and MOF(Government of India and Ministry of finance rules	15
3	**General Insurance** Brief history of general insurance in India, Need of general insurance, Advantages **Fire Insurance:** Meaning , Features, Types of fire insurance policies **Marine Insurance:** Meaning , Features , Risk covered , Types of policies , Types of marine insurance contracts **Motor Vehicle Insurance:** Needs , Features , Different type of policies: (Health , Liability, Personal Accident , Engineering fidelity, Theft , Baggage) **Travel Insurance:** Meaning , Objective , Advantages **Terminologies:** Money Insurance , Burglary Insurance , Engineering Insurance , Contractions All Risk (CAR) Insurance	**20**

4	**Emerging concepts In insurance industry** **Rural Insurance** Need and potential for rural insurance, Different rural insurance policies, Objectives, benefits and schemes Introduction to Aquaculture, Farmers, Fish, Cattle, Floriculture, Horticulture and Poultry insurance An overview of Social Insurance, Unemployment Insurance , Double Insurance	**10**

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	**Recommended References :** 1. Dr. Periaswamy, Principles and Practice of Insurance, Himalaya Publishing house. 2. Dr. P. K Gupta, Insurance and Risk Management, Himalaya Publishing house. 3. Dr. P. K Gupta, Fundamentals and Insurance, Himalaya Publishing house. 4. C. Tyagi and Madhu Tyagi, Insurance Law and Practice, Atlantic Publishers and Distributors 5. Williams, C. Arthur, Risk management and insurance, McGraw Hill. **Recommended Journals:** 1. Journals of Insurance and Risk Management, Birla institute of Management and Technology 2. The journal of insurance institute of India, Insurance Institute of India. **Recommended Websites:** 1. insuranceinstituteofindia.com 2. irdai.gov.in 3. niapune.org.in
Learning Outcomes	On completion of the course student will **LO1.** Have basic understanding of insurance and insurance business. **LO2.** Understand the IRDA functioning and constitutions and other related Acts **LO3.** Comfortably understand the different avenues of insurance. **LO4.** Exhibit an understanding and appreciation of insurance need & purpose

Goa University

Programme: B.C.A.

Course Code: CAG125 **Title of the Course:** Green Computing

Number of Credits: 04 **Effective from AY:** 2020-21

Prerequisites	None
Objectives	**CO1** Understand what Green IT is and how we can meet standards set for Green Computing **CO2** Comprehend Green IT from the perspective of hardware, software, storage, and networking at the enterprise level. **CO3** Strategize Green Initiatives and look at the future of Green IT

	Content	**No. of Hours (60)**
1	**Trends and Reasons to Go Green** • Overview and Issues • Current Initiatives and Standards • Consumption Issues o Minimizing Power Usage o Cooling	**10**
2	**Introduction to Green IT** • Green IT • Holistic Approach to Greening IT • Awareness to Implementation o Green IT Trends o Green Engineering • Greening by IT o Using RFID for Environmental Sustainability o Smart Grids o Smart Buildings and Homes o Green Supply Chain and Logistics o Enterprise-Wide Environmental Sustainability	**10**
3	**Green Hardware and Software** **Green Hardware** • Introduction , • Life Cycle of a Device or Hardware , • Reuse, Recycle and Dispose **Green Software** • Introduction • Energy-Saving Software Techniques **Changing the way we work** • Going Paperless	**10**
4	**Green Data Centers and Storage** **Green Data Centers**	**10**

	• Data Centre IT Infrastructure • Data Centre Facility Infrastructure: Implications for Energy Efficiency • IT Infrastructure Management • Green Data Centre Metrics **Green Data Storage** • Introduction • Storage Media Power Characteristics • Energy Management Techniques for Hard Disks • System-Level Energy Management **Green Networks and Communications** • Introduction • Objectives of Green Network Protocols • Green Network Protocols and Standards	
5	**Enterprise Green IT Strategy** • Introduction • Approaching green IT strategies • Business Drivers of Green IT Strategy • Business Dimensions for Green IT Transformation • Organizational Considerations in a Green IT Strategy • Steps in Developing a Green IT Strategy • Metrics and Measurements in Green Strategies • Organizational and Enterprise Greening • Greening the Enterprise: IT Usage and Hardware	**08**
6	**Managing and Regulating Green IT** **Managing Green IT** • Introduction • Strategizing Green Initiatives • Implementation of Green IT • Information Assurance • Communication and Social Media **Regulating Green IT** • Introduction • The Regulatory Environment and IT Manufacturers • Non-regulatory Government Initiatives • Industry Associations and Standards Bodies • Green Building Standards • Green Data Centres • Social Movements and Greenpeace **The Future of Green IT** • Green Computing and the Future • Megatrends for Green Computing • Tele-presence Instead of Travel • Tele-commuting Instead of Commuting • Deep Green Approach	**12**

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	**Textbooks** 1. Toby Velte, Anthony Velte,Green IT: Reduce Your Information System's Environmental Impact While Adding to the Bottom Line, McGraw Hill Education 2. San Murugesan, G. R. Gangadharan, Harnessing Green IT: Principles and Practices, Wiley, 2013 **References** 1. Bud E. Smith, Green Computing-Tools and Techniques for saving energy, money and resources, Auerbach Publications 2. Mark G. O'Neill, Green IT for Sustainable Business Practice, BCS, The Chartered Institute for IT 3. Jason Harris, Green Computing and Green IT Best Practices, Emereo Pty Ltd
Learning Outcomes	**LO1** Create awareness among stakeholders and promote green initiatives in their environments leading to a green movement. **LO2** Adopt special skills such as knowledge about energy efficiency, ethical IT assets disposal, carbon footprint estimation. **LO3** Create eco-friendly environment.

Goa University

Programme: B.C.A.

Course Code: CAG126 **Title of the Course:** Research Methodology

Number of Credits: 04 **Effective from AY:** 2020-21

Prerequisites		None	
Objectives		**CO1** To understand Research and Research Process **CO2** To acquaint students with identifying problems for research and develop research strategies **CO3** To familiarize students with the techniques of data collection, analysis of data and interpretation	
Content			**No. of Hours (60)**
1	**Introduction and Basic Research Concepts**	Research – Definition; Concept of Construct, Postulate, Proposition, Thesis, Hypothesis, Law, Principle. Research methods vs Methodology, Need of Research in Business and Social Sciences, Objectives of Research , Issues and Problems in Research , Characteristics of Research: Systematic, Valid, Verifiable, Empirical and Critical	**10**
2	**Types of Research**	Basic Research, Applied Research, Descriptive Research, Analytical Research , Empirical Research ,Qualitative and Quantitative Approaches	**10**
3	**Research Design and Sample Design**	Research Design – Meaning, Types and Significance , Sample Design – Meaning and Significance Essentials of a good sampling Stages in Sample Design Sampling methods/techniques Sampling Errors	**10**
4	**Research Methodology**	Meaning of Research Methodology ,Stages in Scientific Research Process: Identification and Selection of Research Problem, Formulation of Research Problem , Review of Literature , Formulation of Hypothesis , Formulation of research Design , Sample Design , Data Collection , Data Analysis , Hypothesis testing and Interpretation of Data , Preparation of Research Report	**10**
5	**Formulating Research Problem**	Considerations: Relevance, Interest, Data Availability, Choice of data, Analysis of data, Generalization and Interpretation of analysis	**10**
6	**Outcome of Research**	Preparation of the report on conclusion reached , Validity Testing & Ethical Issues , Suggestions and Recommendation	**10**
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	**Textbook** 1. Kothari, C.R.1985, Research Methodology-Methods and Techniques, New Delhi, Wiley Eastern Limited. **References** 1. Dawson, Catherine, 2002, Practical Research Methods, New Delhi, UBS Publishers Distributors. 2. Kumar Ranjit, 2005, Research Methodology-A Step-by-Step Guide for Beginners, (2nded), Singapore, Pearson Education **NPTEL Resources** Introduction to Research : https://nptel.ac.in/courses/121/106/121106007/
Learning Outcomes	**LO1** Prepare a preliminary research design for projects in their subject matter areas **LO2** Accurately collect, analyze and report data **LO3** Present complex data or situations clearly **LO4** Review and analyze research findings Get the knowledge of objectives and types of research