Centre for Distance and Online Education (VTU-CDOE)

Bachelor of Computer Applications in Data Analytics

Scheme and Syllabus

Program Outcomes		
Sl No	Description	POs
1	Ability to apply the knowledge of basic mathematics, Computing fundamentals, and programming concepts.	PO1
2	Ability to identify, formulate and analyze real-life problems to provide software solutions.	PO2
3	Ability to design and evaluate the application solutions and process to meet the requirements of various problem domains.	PO3
4	Capable to devise and conduct experiments, understand and interpret data to provide well informed conclusions.	PO4
5	Skill to use the recent techniques, hardware and software tools necessary for computer applications.	PO5
6	Ability to demonstrate computing knowledge with professional and ethical responsibilities.	PO6
7	Exhibiting as a successful computer application professional with an ability of independent learning for continuous need based development.	PO7
8	Ability as a strong team player or a leader by demonstrating knowledge with good understanding of principles of computing, finance and management.	PO8
9	Capable to understand, interpret, design and communicate complex computing activities to the computing community and society by effective presentation and documentation.	PO9
10	Able to understand the impact of computer solutions by considering global, economical, legal, environmental and societal context.	PO10
11	Effective handling of real-time problems as an individual or a leader in multidisciplinary environment.	PO11
12	Ability to identify the opportunity and develop solutions through innovative techniques to create value and wealth as a successful professional or an entrepreneur as per the societal needs.	PO12

Program Education Objectives (PEOs):

PEO 1: Apply Software Engineering for developing computer tools / solutions

PEO 2: Work in a team offline and online mode

PEO 3: High ethical & professional values and lifelong learning skills

BCA in Data Analytics

Semester - I				
Sl. No	**Course Code**	**Course Name**	**Type of the Course**	**Credits**
1	OBCA101	Foundation Mathematics -I	Core	4
2	OBCA102	Fundamentals of Computers	Core	4
3	OBCA103	Programming in C	Core / Skill	4
4	OBCA104	Introduction to Operating system	Core	4
5	OBCA105	Programming in C Lab	Skill	2
6	OBCA106	IT Lab	Skill	2
Total				20

Semester - II				
Sl. No	**Course Code**	**Course Name**	**Type of the Course**	**Credits**
1	OBCA201	Data Structures using C++	Core	4
2	OBCA202	Foundation Mathematics –II	Core	4
3	OBCA203	Professional Communication and Ethics	Core / Skill	4
4	OBCA204	Database Management System	Core	4
5	OBCA205	Database Management System Lab	Skill	2
6	OBCA206	Data Structure Lab	Skill	2
Total				20

Semester - III				
Sl. No	**Course Code**	**Course Name**	**Type of the Course**	**Credits**
1	OBCA301	Python Programming	Core	4
2	OBCA302	Object Oriented Programming Using Java	Core	4
3	OBCA303	Analysis & Design of Algorithm	Core / Skill	4
4	OBCA304	Computer Networks	Core	4
5	OBCA305	Python Lab	Skill	2
6	OBCA306	Java Lab	Skill	2
Total				20

Semester - IV				
Sl. No	**Course Code**	**Course Name**	**Type of the Course**	**Credits**
1	OBCA401	Web Programming	Core	4
2	OBCA402	Introduction to Numpy and Pandas	Core	4
3	OBCA403	Software Engineering	Core / Skill	4
4	OBCA404	Introduction to Artificial Intelligence	Core	4
5	OBCA405	Web Lab	Skill	2
6	OBCA406	Programming Lab Using Python - - Numpy and Pandas	Skill	2
Total				20

Semester - V				
Sl. No	**Course Code**	**Course Name**	**Type of the Course**	**Credits**
1	OBCA501	Computer System & Network Security	Core	4
2	OBCA502	Machine Learning	Core / Skill	4
3	OBCA503	Introduction to Data Mining	Core	4
4	OBCA504	Big Data Analytics	Core	4
5	OBCA505	ML Lab	Skill	2
6	OBCA506	Mini Project	Skill	2
Total				20

Semester - VI				
Sl. No	**Course Code**	**Course Name**	**Type of the Course**	**Credits**
1	OBCA601	Cloud Computing	Core	4
2	OBCA602	Internship and Seminar	Core / Skill	4
3	OBCA603	Project Work	Core / Skill	12
Total				20

Foundation of Mathematics –I		Semester	I
Course Code	OBCA101	CIE Marks	30
		SEE Marks	70
Credits	4	Total Marks	100
		Exam Hours	3
Examination nature (SEE)	Theory		

Course objectives:

- The Curriculum supports the prerequisites to enhance their Mathematical knowledge towards their understanding mathematical Concepts in the concerned fields.

MODULE-1

MATRICES Definition, Types of Matrices, Addition, Subtraction, Scalar Multiplication and Multiplication of Matrices, Adjoint, Inverse, Eigen values and Eigen Vectors of a Matrix, Caley-Hamilton Theorem (Statement only) Rank of a matrix, Row reduced echelon form and normal form Solution of homogeneous and non homogeneous system of linear equations.

MODULE-2

SETS: Sets, Subsets, Types of Sets, Operation on Sets, Cartesian product , Cardinality of sets and applications.

MODULE-3

ALGEBRAIC STRUCTURES: Binary operations, groups, semi-groups, subgroups, normal subgroups, isomorphism and homomorphism.
RINGS: Integral domains and fields.

MODULE-4

DIFFERENTIAL CALCULUS: Limits, Continuity, Successive differentiation, n^{th} derivative of standard functions, Leibnitz theorem for finding n^{th} derivative of product of two functions. Taylor's series and Maclaurin's series.
Partial differentiation: Partial derivatives, homogeneous function, Euler's theorem, maxima and minima for function of two variables.

MODULE-5

ORDINARY DIFFERENTIAL EQUATIONS (ODE'S)OF FIRST ORDER WITH FIRST DEGREE
Variable separable, Homogenous, Reducible to homogenous, Linear, Reducible to linear and Exact ODE'S. Application: Orthogonal Trajectories.

Course Outcomes:

CO1: Develop basic knowledge of matrices and to solve system of linear equations.

CO2: Understand the basic concepts of sets, functions and relations..

CO3: Understand the concept of groups, rings and isomorphism for algorithms.

CO4: Develop the knowledge about derivatives and applications of differentiation.

CO5: Solve first order with first degree ODE'S using standard methods.

Suggested Learning Resources:

Text Books Reference Books:

1. Discrete Mathematics by Guru Raja Chaar.

2. B.S.Grewal: Higher Engineering Mathematics Khanna Publishers, 43rd Edition.

3. Erwin Kreyszig: Advanced Engineering Mathematics, John Wiley and Sons

4. David C Lay: Linear Algebra and its Applications , Cambridge University Press

Fundamentals of Computers		Semester	I
Course Code	OBCA102	CIE Marks	30
		SEE Marks	70
Credits	4	Total Marks	100
		Exam Hours	3
Examination nature (SEE)	Theory		

Course objectives:

- A foundation from which they can appreciate the relevance and interrelationships of further courses in the field. This course provides an insight into the general structures of operating systems, database management systems, and computer networks.
- Operating System acts as a platform of information exchange between a computer's hardware and the applications running on it.
- Database Management Systems have become a part of all computer-based systems automating real word applications to handle data storage.
- Computer Networks deal with components and principles of networks and their protocols.

MODULE-1

Introduction to computers: Characteristics of computers, Classification of Digital Computer Systems: Microcomputers, Minicomputers, Mainframes, Supercomputers. Anatomy of Computer: Introduction, Functions & Components of a Computer, Central Processing Unit, Microprocessor, Storage units, Input and output Devices. How CPU and memory works. Program execution with illustrative examples. Introduction to microcontrollers.

MODULE-2

Operating System Fundamentals: Operating Systems: Introduction, Functions of an operating System, Classification of Operating Systems, System programs, Application programs, Utilities, The Unix Operating System, Basic Unix commands.

MODULE-3

Introduction to Database Management Systems: Database, DBMS, Why Database - File system vs DBMS, Database applications, Database users, Introduction to SQL, Data types, Classification of SQL-DDL with constraints, DML, DCL

MODULE-4

Computer Networks: Data transmission media, Network types and Topologies, Network devices, Network architecture, Application layer protocols, obtains essential system network information using system tools: network interfaces and their addresses, active processes using network communication. Basic network debugging: using trace route to discover route to a remote computer, ping to check network connectivity.

MODULE-5

Internet & Web Basics: Introduction, Features of Internet, Internet application, Services of Internet, Logical and physical addresses, Internet Service Providers, Domain Name System. Web Basics: Introduction to web, webpages and websites, web browsers, http/https, URL.

Course outcomes :

CO1: Discover the basics of computers, classification of computers, anatomy of computer, constituents and architecture, computer networks, microcontrollers.

CO2: Interpret operating systems, functions of o/s, classification of operating systems

CO3: Illustrate databases, why databases are used, sql, datatypes in sql, introduction of queries

Suggested Learning Resources:

Books

1. J. Glenn Brookshear," Computer Science: An Overview", Addision-Wesley, Twelfth Edition, 2014
2. Silberschatz A, Gagne G, Galvin PB. Operating system concepts. Ninth Edition, Wiley; 2012.
3. Cobbaut P. Linux Fundamentals. Samurai Media Limited; 2016.
4. Silberschatz A, Korth HF, Sudarshan S. Database system concepts. Sixth Edition, McGraw Hill; 2010.

Programming in C		Semester	I
Course Code	OBCA103	CIE Marks	30
		SEE Marks	70
Credits	4	Total Marks	100
		Exam Hours	3
Examination nature (SEE)	Theory		

Course objectives:

- To develop skills in solving problems, to obtain knowledge about the structure of the programming language C and to develop the program writing and logical thinking skill.

MODULE-1

Problem Solving techniques: Introduction, Problem solving procedure, Algorithm: Steps involved in algorithm development, Algorithms for simple problems: To find largest of three numbers, factorial of number , check for prime number ,check for palindrome , Count no.of odd , even and zeros in list of integers. Flowcharts: Definition, advantages, Symbols used in flow charts.Flowcharts for simpleproblems mentioned in algorithms. Psuedocode.

MODULE-2

Introduction to C: Overview of C Program, Importance of C Program, Basic structure of a C-program, Execution of C Program. Constants, Variables & Data types: Character set, C token, Keywords & identifiers, Constants, Variables, datat ypes, Declaration of variables, assigning values to variables, defining symbolic constants. **Operators and Expression:** Arithmetic, Relational, logical, assignment, increment & decrement, conditional, bit wise & special operators, evaluation of expressions, Precedence of arithmetic operators, type conversions in expressions, operator precedence & Associativity, built in mathematical functions.

MODULE-3

Managing Input and Output operations: Reading & writing a character, formatted input and output. Decision Making and Branching: Decision making with if statement, simple if statement, the if else statement, nesting of if … else statements, the else if ladder, the switch statement, the ?: operator, the goto statement. Decision making and looping: The while statement, the do statement, for statement, exit, break, jumps in loops.

MODULE-4

Arrays: Declaration, initialization & access of one dimensional & two dimensional arrays. Programs using one and two dimensional arrays- sorting and searching arrays. Handling of Strings: Declaring &initializing string variables, reading strings from terminal, writing strings to screen, Arithmetic operations on characters, String Handling functions, table of strings. **User defined functions:** Need for user defined functions, Declaring, defining and calling C functions return values & their types, Categories of functions: With/without arguments, with/without return values. Nesting of functions

MODULE-5
Recursion: Definition, example programs. Storage classes: The scope, visibility & lifetime of variables. Structures and union: Structure definition, giving values to members, structure initialization, comparison of structure variables, arrays of structures, arrays within structures, Structure and functions, structures within structures. Unions. **Pointers:** Understanding pointers, accessing the address of a variable, declaring & initializing pointers, accessing a variable through its pointer, pointer expression, pointer increments & scale factor, pointers & arrays, Pointer and strings, passing pointer variables as function arguments. **File Management**- Create in Read/Write and Append mode, copying file.

Course outcomes :

CO1: Describe the C Programming language which includes the structure of a C program, Tokens, Expressions, Operators etc.

CO2: Demonstrate conditional and iterative statements to write C programs.

CO3: Construct the C programs that use pointers to access arrays and strings.

CO4: Illustrate the user defined functions to solve real time problems.

Suggested Learning Resources:

Books

1. Computer Fundamentals and Programming in C – Reema Thareja, 2nd Edition, Oxford University, 2017.
2. E. Balaguruswamy, Programming in ANSI C, 7th Edition, Tata McGraw-Hill
3. Brian W. Kernighan and Dennis M. Ritchie, The 'C' Programming Language, Prentice Hall of IndiaYashavanth Kanetkar, Let us C, Authentic Guide to C Programming Langauge, bpb publisher, 17th Edition, 2020
4. Yashavanth Kanetkar, Let us C, Authentic Guide to C Programming Langauge, bpb publisher, 17th Edition, 2020

Introduction to Operating system		Semester	I
Course Code	OBCA104	CIE Marks	30
		SEE Marks	70
Credits	4	Total Marks	100
		Exam Hours	3
Examination nature (SEE)	Theory		

Course objectives:

- The objectives of this subject are to provide the basic feature, function and interface with the hardware and application software to run the computer smoothly.

MODULE-1

Introduction: Definition, Computer system components, User view, system view and system goals , Batch Systems, Multi programmed Systems, Time-Sharing Systems, Real-Time Systems, System Components, Operating system services, System calls and system programs.

MODULE-2

Process: Process Concept, process state diagram process Control block , Process Scheduling- Scheduling queues, scheduler, Cooperating process, Interprocess Communication, Threads- meaning , user threads , Kernel Threads, Multithreading Models, Threading Issues.

CPU Scheduling Basic concepts, Preemptive and Non-preemeptive Scheduling, Scheduling Criteria, Scheduling algorithms FCFS, Shortest job first Priority scheduling, Round Robin Scheduling.

MODULE-3

Process Synchronization The Critical section problem, Solution Approach critical section problem, Bakery Algorithm, Semaphores Meaning, Types of Semaphores, Synchronization problems- Bounded Buffer Problem, Readers-Writers problem and Dining Philosophers problem.

Deadlocks Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

MODULE-4

Memory Management Introduction, Logical versus physical address space, Dynamic Loading, Dynamic Linking, Swapping, Contiguous Allocation, Partitioned Memory Allocation, Paging, Segmentation, Segmentation with Paging.

MODULE-5

File System File concepts, File Attributes, File Operations, File Types, File Structure, Access Methods, Directory Structure, File-System Structure, Allocation Methods-Contiguous Allocation, Linked Allocation and Indexed Allocation, Free-Space Management.

Course outcomes:

CO1: Describe the basic concepts of OS with different types of OS, different services along with the various system calls

CO2: Interpret process management, various operations on process and Inter process communication

CO3: Simulate the various process scheduling algorithms

CO4:Analyze process synchronization, deadlocks, methods of handling deadlocks, preventing deadlocks etc

Suggested Learning Resources:

Textbooks & Reference Books

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 10th edition, Wiley-India, 2018
2. D.M Dhamdhere, Operating Systems: A Concept Based Approach 3rd Ed, McGraw- Hill, 2013.
3. William Stallings Operating Systems: Internals and Design Principles, 9th Edition, Pearson.
4. Andrew S.Tanenbaum, "Modern operating Systems", fourth Edition, PHI Learning Pvt.Ltd., 2008

Programming in C Lab		Semester	I
Course Code	OBCA105	CIE Marks	30
		SEE Marks	70
Credits	2	Total Marks	100
		Exam Hours	3
Examination nature (SEE)	Practical		

Part A:

1. Program to read radius of a circle and to find area and circumference
2. Program to read three numbers and find the biggest of three
3. Program to demonstrate library functions in math.h
4. Program to check for prime
5. Program to generate n primes
6. Program to read a number, find the sum of the digits, reverse the number and check it for palindrome
7. Program to read percentage of marks and to display appropriate message (Demonstration of else-if)
8. Program to find the roots of quadratic equation (demonstration of switch Case statement)
9. Program to remove Duplicate Element in a single dimensional Array

Part B:

1. Program to find the length of a string without using built in function
2. Program to demonstrate string functions.
3. Program to demonstrate pointers in C
4. Program to read, display and to find the trace of a square matrix
5. Program to read, display and add two m x n matrices using functions
6. Program to read, display and multiply two m x n matrices using functions
7. Program to read a string and to find the number of alphabets, digits, vowels, consonants, spaces and special characters.
8. Program to Reverse a String using Pointer
9. Program to Swap Two Numbers using Pointers
10. Program to demonstrate student structure to read & display records of n students.

Course outcomes :

CO1: Develop the C Program which includes the structure of a C program, Tokens, Expressions, Operators etc.
CO2: Demonstrate conditional and iterative statements to write C programs.
CO3: Construct the C programs that use pointers to access arrays and strings.
CO4: Design the user defined functions to solve real time problems.

IT Lab		Semester	I
Course Code	OBCA106	CIE Marks	30
		SEE Marks	70
Credits	2	Total Marks	100
		Exam Hours	3
Examination nature (SEE)	Practical		

Part A: Hardware

1. Identification of the peripherals of a computer, components in a CPU and their functions.
2. Assembling and disassembling the system hardware components of personal computer.
3. Basic Computer Hardware Trouble shooting.
4. LAN and WiFi Basics.
5. Operating System Installation – Windows OS, UNIX/LINUX, Dual Booting.
6. System Configuration – BIOS Settings, Registry Editor, MS Config, Task Manager, System Maintenance, Third-party System Maintenance Tools.

Part B: Software

1. Activities using Word Processor Software
2. Activities using Spreadsheets Software
3. Activities using Presentation Software
4. Activities involving Multimedia Editing
5. Tasks involving Internet Browsing
6. Flow charts: Installation and using of flowgarithms software for different arithmetic tasks like sum, average, product, difference, quotient and remainder of given numbers, calculate area of Shapes arrays and recursion.

Course outcomes :

CO1: Discover the basics of computers, classification of computers, anatomy of computer, constituents and architecture, computer networks, microcontrollers.

CO2: Able to install operating systems such as windows, linux, dual booting, etc

CO3: Illustrate the activities using word processor, spreadsheets, presentation software, etc

SEMESTER - II

Data Structures using C++		Semester	II
Course Code	OBCA201	CIE Marks	30
		SEE Marks	70
Credits	4	Total Marks	100
		Exam Hours	3
Examination nature (SEE)	Theory		

Course objectives:

- Fundamentals of data structures
- Basic concepts related to stacks, queues.
- Fundamentals of graphs, Multilists and file organization

MODULE-1

Introduction to Data Structure and its Characteristics Array Representation of single and multidimensional arrays; Sparse arrays – lower and upper triangular matrices and Tri-diagonal matrices with Vector Representation.

MODULE-2

Stacks and Queues

Introduction and primitive operations on stack; Stack application; Infix, postfix, prefix expressions; Evaluation of postfix expression; Conversion between prefix, infix and postfix, introduction and primitive operation on queues, D- queues and priority queues.

MODULE-3

Lists

Introduction to linked lists; Sequential and linked lists, operations such as traversal, insertion, deletion searching, two way lists.

MODULE-4

Trees

Introduction and terminology; Traversal of binary trees; Recursive algorithms for tree operations such as traversal, insertion, deletion; Binary Search Tree

MODULE-5

Graphs

Graph terminology, Representation of graphs, path matrix, BFS (breadth first search), DFS (depth first search), topological sorting, Warshall's algorithm (shortest path algorithm.)

Course outcomes:

CO 1 : Identify different types of data structures, operations and algorithms
CO 2: Illustrate searching and sorting operations on files
CO 3:Demonstrate the working of stack, Queue, Lists, Trees and Graphs in problem solving & implement all data structures in a high-level language for problem solving

Suggested Learning Resources: Books

1. Adam Drozdek, "Data Structures and Algorithms in C++", 2013, Fourth Edition, Cengage Learning
2. Bhushan Trivedi, "Programming with ANSI C++", Oxford Press, Second Edition, 2012.
3. Balagurusamy E, Object Oriented Programming with C++, Tata McGraw Hill Education Pvt.Ltd, Fourth Edition 2010.
4. R.S. Salaria, " Data Structures & Algorithms" , Khanna Book Publishing Co. (P)Ltd..,2002

Foundation of Mathematics -II		Semester	II
Course Code	OBCA202	CIE Marks	30
		SEE Marks	70
Credits	4	Total Marks	100
		Exam Hours	3
Examination Nature (SEE)	Theory		

Course objectives:

- The objective of this course is to better understanding on the concepts of Sets, Relations and Functions, Laplace transformations and multiple integrals.

MODULE-1

RELATIONS AND FUNCTIONS:

RELATIONS: Definition with illustrations, Representation of relations to Zero-one matrix and digraphs.

FUNCTIONS: Definition, Domain and Range of function, Types of functions with illustrations.

MODULE-2

RELATIONS & FUNCTIONS

RELATIONS: Properties of relations, Equivalence relation, Partitions.

FUNCTIONS: Composite and Inverse Functions, Introduction to trigonometric, logarithmic and exponential functions.

MODULE-3

PARTIAL ORDER RELATIONS & LATTICES

Partial order sets, Representation of Posets using Hasse diagram, Chains, Elements of posets.

LATTICES

Algebraic systems, Principle of Duality, Basic properties, Sublattices, Distributed and Complemented Lattices.

MODULE-4

LAPLACE TRANSFORM:

Definition , Laplace transform of elementary functions, Periodic functions and Unit step functions, problems,

INVERSE LAPLACE TRSNSFORM:

Inverse Laplace transform of elementary functions, simple problems.

MODULE-5

MULTIPLE INTEGRALS:

Double and triple integrals, Evaluation of double integral by changing the order of integration.

Applications: Area and Volume by double integration.

Course Outcomes:

CO1: Understand the concepts of representations of relations and functions.

CO2: Develop knowledge of partitions, trigonometric and exponential of relations and functions.

CO3: Understand the concept of representation of Hasse diagram and types of Lattices.

CO4: Develop the knowledge about Laplace transform and its applications. .

CO5: Understand the basic concepts of Multiple integrals in Cartesian and polar forms**.**

Suggested Learning Resources:

Text Books

1. S.K. Sarkar, Discrete Mathematics by S.Chand & Co
2. B.S.Grewal: Higher Engineering Mathematics Khanna Publishers, 43rd Edition.
3. Erwin Kreyszig: Advanced Engineering Mathematics, John Wiley and Sons
4. David C Lay: Linear Algebra and its Applications , Cambridge University Press
5. J.P.Chauhan, BCA Mathematics Volume 2, Krishna Publications

Professional Communication and Ethics		Semester	II
Course Code	OBCA203	CIE Marks	30
		SEE Marks	70
Credits	4	Total Marks	100
		Exam Hours	3
Examination nature (SEE)	Theory		

Course objectives:

- To help students obtain an ability to communicate fluently in English; to enable and enhance the students skills in reading, writing, listening and speaking; to impart an aesthetic sense and enhance creativity

MODULE-1

Professional / Technical Communication

Introduction, process of communication, language as a tool, levels of communication, communication networks, importance of technical communication.

MODULE-2

Barriers to communication & Technology in communication

Definition of noise, classification of barriers, impact of technology, software for creating messages, software for writing documents, software for presenting documents, transmitting documents, effective use of available technology.

MODULE-3

Active Listening and effective presentation

Introduction, types of listening, traits of good listener, active versus passive listening, implications of effective listening.

Presentation purpose, analyzing audience and locals, organizing contents, preparing outline, visual aids, understanding nuances of delivery, kinetics, proxemics.

MODULE-4

Group communication, Research paper, Dissertations and Thesis

Group discussions, group discussions as part of selection process, meetings, conferences, research paper, dissertation, and thesis.

MODULE-5

Ethics for IT professional and IT users

Ethics in the business world, ethics in Information Technology(IT), IT professionals, ethical behavior of IT professional, IT users.

Course outcomes:

CO1: Develop vocabulary and language skills relevant to engineering as a profession

CO2: Analyze, interpret and effectively summarize a variety of textual content.

CO3: Create effective technical presentations

CO4: Acquire the Create effective technical presentations.

Suggested Learning Resources:
Books:

1. Meenakshi Raman and Sangeeta Sharama: "Technical Communication – Principles of Practices, Oxford University Press.
2. George Reynolds: "Ethics in Information Technology, Thomson Course Technology.
3. M.Govindarajan, S.Natarajananad, V.S.SenthilKumar "Engineering Ethics includes Human Values" -PHI Learning Pvt. Ltd-2009
4. Prof.A.R.Aryasri, DharanikotaSuyodhana "Professional Ethics and Morals" Maruthi Publications

Database Management System		Semester	II
Course Code	OBCA204	CIE Marks	30
		SEE Marks	70
Credits	4	Total Marks	100
		Exam Hours	3
Examination nature (SEE)	Theory		

Course objectives:

- Explain the foundation in database concepts, technology, and practice.
- Define SQL programming through a variety of database problems.
- Demonstrate the use of concurrency and transactions in database
- Design and build database applications for real world problems

MODULE-1

Introduction - Data Independence - The Three Levels Of Architecture - The External Level - Conceptual Level - Internal Level - Client/Server Architecture- System Structure , Instance and schema, Data Models, Types of DBMS

MODULE-2

Keys - CODD's Rules, Design Issues -ER – Model –Attribute types- Weak Entity Sets - Extended ER Features –ER to Relational Mapping, Structure Of Relational Databases

MODULE-3

Normalization –Anomalies- Functional Dependency: Armstrong's axioms- closure of a relation and closure of attribute– Lossless decomposition-1NF, 2NF, 3NF, Boyce - Codd Normal Form

MODULE-4

The Relational Algebra -- Query Processing and Optimization Transaction Processing: ACID properties, states of a transaction-Introduction to concurrency control

MODULE-5

DDL, Constraints, LIKE, BETWEEN, Conjunction and disjunction, Order by, Group by, Built in SQL functions- Set operations, Sub Queries-Joins-DCL – TCL- Views – Sequences – Index PL/SQL Basics – Exceptions – Cursors - Stored Functions – Triggers

Course Outcomes:

CO 1: Identify and define database objects, enforce integrity constraints on a database using RDBMS.

CO 2: Demonstrate the Structured Query Language (SQL) for database manipulation.

CO 3: Construct simple database systems & applications to interact with databases

Suggested Learning Resources:

Books

1. Fundamentals of Database Systems, Ramez Elmasri and Shamkant B. Navathe, 7th Edition, 2017, Pearson.

2. Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill.

3. Abraham Silberschatz, Henry F. Korth and S. Sudarshan"s Database System Concepts 9th EditionTata Mcgraw Hill Education Private Limited-2013

4. Introduction to Database Management System ,Satinder bal Gupta,Aditiya Mittal,2nd Edition,An imprint of Laxmi publications Private Limited-2017

Database Management System Lab		Semester	II
Course Code	OBCA205	CIE Marks	30
		SEE Marks	70
Credits	2	Total Marks	100
		Exam Hours	3
Examination nature (SEE)	Lab		

1. The EMP detail databases has a table with the following attributes.

The primary keys are underlined. EMP (EmpNo: int, name: string, dob: date, Ph No: int)

a) Create the above table.
b) Remove the existing attributes from the table.
c) Change the date type of regno from integer to string.
d) Add a new attribute Date of Joining (DOJ) to the existing table.
e) Enter five tuples into the table.
f) Display all the tuples in student table.

2. A LIBRARY database has a table with the following attributes.

LIBRARY (bookid:int, title: string, author: string, publication: string, yearpub:int, price: real) a) Create the above table.
b) Enter the five tuples into the table
c) Display all the tuples in student table.
d) Display the different publishers from the list.
e) Arrange the tuples in the alphabetical order of the book titles.
f) List the details of all the books whose price ranges between Rs. 100 and Rs. 300

3. The SALARY database of an organization has a table with the following attributes. EMPSALARY (empcod:int, emp_name: string, dob: date, department: string, salary: real)

a) Create the above table.
b) Enter the five tuples into the table
c) Display all the number of employees working in each department.
d) Find the sum of the salaries of all employees.
e) Find the sum and average of the salaries of employees of a particular department.
f) Find the least and highest salaries that an employee draws.

- **Consider the following database of student's enrollment in courses and books adopted for each course. STUDENT (regno: string, name: string, major: strong, bdate: date)**

  COURSE (course-no: int cname: string, dept: string)
  ENROLL (reg-no: string, course-no: int, sem: int, marks: int)
  BOOK-ADOPTION (course-no: int, sem: int, book-isbn: int)
  TEXT (book-isbn: int, book-title: string, publisher: string, author: string)
  a) Create the above tables by properly specifying the primary keys and the foreign keys
  b) Enter at least five tuples for each relation.
  c) Demonstrate how you add a new text book to the database and make this book be adopted by some department.
  d) List any department that has all its adopted books published by a specific publisher.

Course Outcomes:

CO 1: Design and develop database objects, enforce integrity constraints on a database using RDBMS.

CO 2: Illustrate the Structured Query Language (SQL) for database manipulation.

CO 3: Construct simple database systems & applications to interact with databases

Data Structure Lab		Semester	II
Course Code	OBCA206	CIE Marks	30
		SEE Marks	70
Credits	2	Total Marks	100
		Exam Hours	3
Examination nature (SEE)	Lab		

1. Write a menu driven C++ program to perform the following string operations without using string functions: (i) String Length (ii) String Concatenation (ii) String Reverse

2. Write a C++ program to search for an element in an array using Binary search.

3. Write a C++ program to sort a list of N elements using Merge sort technique.

4. Write a C++ program to sort a list of N elements of integer type using Quick Sort technique.

5. Write a C++ program to find the Binomial Coefficient using recursion.

6. Write a C++ program to simulate the working of Towers of Hanoi problem for N disks, print the moves taken by the problem using recursion.

7. Write a C++ program to demonstrate the working of a stack using an array. The elements of the stack may be integers. Operations to be supported are 1.PUSH, 2.POP 3.DISPLAY. The program should print appropriate messages for STACK overflow, Underflow.

8. Write a C++ program to implement the operations of a Queue using linked list.

Course outcomes:

CO 1 : Illustrate different types of data structures, operations and algorithms, searching and sorting operations on files

CO 2: Design & develop the working of stack, Queue, Lists in problem solving & implement all data structures

SEMESTER- III

Python Programming		**Semester**	**III**
Course Code	**OBCA301**	**CIE Marks**	**30**
		SEE Marks	**70**
Credits	**4**	**Total Marks**	**100**
		Exam Hours	**3**
Examination nature (SEE)	**Theory**		

Course objectives:

- Study the importance of Object Oriented Programming
- Explore the Object Oriented Programming concepts
- Explain the concept of Polymorphism, Inheritance
- Understand the creation of modules ,packages and organization of modules and packages

MODULE-1

Python Basics: Python interpreter, Python idle dynamically typed and strongly typed features basic data types, variables, expressions, statements, operators, flow of execution, Input and Output statements, Conditionals: Boolean values and operators, conditional (if) alternative (if-else) chained conditional (if –elif-else), Iteration: while, for, break, continue. pass, Implementing _for' through ranger *in and *not in operators for sequence traversal. Creating and executing: py scripts.

MODULE-2

Data Structures: Lists: append, extend, insert, Index, remove, pop, count, sort, reverse, slicing, list comprehension, Copying a list deep copy, shallow copy. Tuples- index, count. Usage, use of tuples as a swap function. Dictionaries keys, values, tuples, nested dictionaries dictionary comprehension, Strings- single line and multi-line strings, formatter, isdigit, isalpha, isalnum, islower, isupper, isspace, title, lower, Upper, strip, split. splitlines join etc. Sets union, intersection, Subset superset, difference Symmetric difference, copy, add, remove, discard Etc

MODULE-3

Functions & File Handling: built Functions- id, len, chr, ord etc defining and calling function, arguments, global versus local variables, defining and using lambda functions. map(),filter(), reduce() functions. Working with files: read, write and append modes: r, w, a, r+, w+, a+, reading-read(), readline(), readlines(), writing-write(), writelines(), seek(), tell(). Word count, copy file scripts through file handling concepts.

MODULE-4
Classes, modules and exceptional handling: Classes: Introduction, Member variables and defining methods, constructor, destructor, data encapsulation, inheritances, multiple inheritances, diamond problem solving technique of python. Modules inbuilt modules-sys, random, time etc. import, from import, from import * Constructing packages role of _init _.py. Exceptional Handling: The Try-exceptelse-finally block, the raise statement, the hierarchy of exceptions, adding exceptions.
MODULE-5
Database & GUI Programming: importing SQLite, connecting to database, creating table, insert, select, update, delete. Drop tables, accessing and modifying tables through python. Graphical user interfaces: event-driven programming paradigm, Tkinter module, creating simple GUI: buttons, labels, entry fields. Dialogs: widget attributes – sizes, fonts, colors layouts, nested frames

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

CO1: Explore the importance of Object Oriented Programming in python

CO2: Describe the concept of Polymorphism and Inheritance, etc.

CO3: Construct classes, modules, packages and organization of modules and packages, GUI programming.

Suggested Learning Resources:

Books

1. Introduction to Programming Using Python‖, 1 st Edition, Liang Y. Daniel, Pearson, 2017
2. Python the complete reference ,Martin C. Brown,4th Edition, McGraw Hill Education ,2018
3. Python 3 Object Oriented Programming, 2nd Edition, Unleash the power of Python 3 Objects by Dusty Phillips , PACKT Publishing.
4. Python Object–Oriented Programming :Build robust and maintainable Object-oriented python applications and libraries, Steven F. Lott, Dusty Philips,4th Edition, Packt Publishing Limited; 2021

Object Oriented Programming Using Java		Semester	III
Course Code	OBCA302	CIE Marks	30
		SEE Marks	70
Credits	4	Total Marks	100
		Exam Hours	3
Examination nature (SEE)	Theory		

Course objectives:

- Understand the Java program structure, data types and statements.
- Learn the concepts of class, objects and methods using JDK tools.
- Explore concepts of inheritance, overloading and multi-threaded programming
- Explore the use built-in packages and create user-defined packages Applet programming

MODULE-1

History and features of java, C++ Vs java, how java works, JAVA Program Structure, Java Virtual Machine concepts, java platform overview, Primitive data types, variables and constants, operators, expression statement- branching, looping and jumping, labeled statements.

MODULE-2

Classes, objects and methods: defining a class, creating object, adding variables and methods, Constructor Instances, field and methods initialization by constructors, Types of constructor, memory allocation and garbage collection, access methods Arrays, String and String buffer classes.

MODULE-3

Inheritance, Super class Subclass, basic types, using super keyword, abstract and final classes, method overriding, dynamics method dispatch. Method overloading, Interface, Thread, Thread Life cycle, Multithreading examples, Synchronized threading, Priorities of thread.

MODULE-4

Exception handling: fundamental, exception types, uncaught exception, throws, throw, try-catch, finally, built in exception, creating your own exception, Packages, Built in Packages, Creating your own Package, input/output-basics streams, Byte and character streams.

MODULE-5

Applet programming-Local and Remote Applets, Applet Vs Application, creating and executing java applets, inserting applets in a web page, java security, passing parameter to applets, Aligning the Display, HTML Tags & Applet Tag, Getting Input from User.

Course Outcomes:

CO 1: Explore the object-oriented concepts and JAVA.

CO 2: Demonstrate programs to solve real world problems in Java.

CO 3: Construct simple GUI interfaces for a computer program to interact with users

Suggested Learning Resources:

Books

1. Programming with Java,6th Edition, E.Balaguruswamy, McGraw-Hill, 2019
2. Internet and Java Programming, 1 st Edition, Prabhu, R. Krishnamurthy, New Age International,2013
3. Java Fundamentals, A comprehensive Introduction by Herbert Schildt, Dale Skrien. Tata McGraw Hill Edition 2013. (Chapters:1,2,3,4,5,6,7,8,9,10, 11,12,13,15,22, 23,24,25, 26)
4. Java6 Programming,Black Book,KoGenT, Dreamtech Press,2012.

Analysis & Design of Algorithm		Semester	III
Course Code	OBCA303	CIE Marks	30
		SEE Marks	70
Credits	4	Total Marks	100
		Exam Hours	3
Examination nature (SEE)	Theory		

Course objectives:

- Explain various computational problem solving techniques.
- Apply appropriate method to solve a given problem.
- Describe various methods of algorithm analysis.

MODULE-1

Introduction: Algorithms, Fundamentals of Algorithmic Problem Solving, Important Problem Types, Fundamental Data Structures. Fundamentals of the Analysis of Algorithm Efficiency: The Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non-recursive and Recursive Algorithms, Empirical Analysis of Algorithms

MODULE-2

Brute Force Method: Selection Sort and Bubble Sort, Sequential Search, Brute-Force String Matching, Exhaustive Search, Depth-First Search and Breadth-First Search. Decrease and Conquer: Insertion Sort, Topological Sorting, Algorithms for Generating Combinatorial Objects, Decreaseby-a-Constant-Factor Algorithms.

MODULE-3

Divide and Conquer: Merge Sort, Quick Sort, Binary Tree Traversals and Related Properties, Strassen's Matrix Multiplication. Space and Time Tradeoffs: Sorting by Counting, Input Enhancement in String Matching, Hashing. Dynamic programming: Binomial Coefficient, Principle of Optimality, Optimal Binary Search Trees, Knapsack Problem and Memory Functions, Warshall's and Floyd's Algorithms.

MODULE-4

Greedy Technique: Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees. Limitations of Algorithm Power: Lower-Bound Arguments, Decision Trees, P, NP and NP Complete Problems.

MODULE-5

Coping with the Limitations of Algorithm Power: Back Tracking: n Queens problem, Hamiltonian Circuit Problem, Subset-Sum Problem. Branch-and-Bound: Assignment Problem, Knapsack Problem, Traveling Salesman Problem.

Course Outcomes:

CO 1: Describe computational solution to well known problems like searching, sorting etc.

CO 2: Identify the computational complexity of different algorithms.

CO 3: Explain an algorithm using appropriate design strategies for problem solving

Suggested Learning Resources:

Books

1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", 3rd Edition, Pearson, 2012
2. Horowitz, Sahni, Rajasekaran, "Fundamentals of Computer Algorithms", 2/e, Universities Press, 2007.
3. Introduction to the Design and Analysis of Algorithms, Anany Levitin:, 2rd Edition, 2009. Pearson.
4. Computer Algorithms/C++, Ellis Horowitz, Satraj Sahni and Rajasekaran, 2nd Edition, 2014, Universities Press

Computer Networks		Semester	III
Course Code	OBCA304	CIE Marks	30
		SEE Marks	70
Credits	4	Total Marks	100
		Exam Hours	3
Examination nature (SEE)	Theory		

Course objectives:

- Comprehend the transmission technique of digital data between two or more computers and a computer network that allows computers to exchange data.
- Explain with the basics of data communication and various types of computer networks;
- Demonstrate Medium Access Control protocols for reliable and noisy channels.
- Expose wireless and wired LANs.

MODULE-1

Definition and concept of networking transmission modes. Transmission media, Internet working, Connecting devices, Adapters. Routers, evolution of Network Technology, Standards and protocols, Introduction to Analog signals, Digital signal, Modulation and Demodulation, OSI Reference Model-Layered structure, function of each layer, protocol used

MODULE-2

Switching-Message. Packet, and Circuit Switching, Multiplexing – FDM, TDM WDM, SONNET, Cellular network, satellite network, IEEE 802 STANDARDSCSMA/CD, TOKEN BUS, TOKEN RING, FDDI. Routing algorithms — Distance Vector routing, Link state routing, TCP/IP- Overview. Architectures, functions of each layers and protocol, IP addressing, subnet and subnet mask, IP addressing-classes, IPV4 IPV6.

MODULE-3

Bootstrap protocol, DHCP, mobile IP, DNS, Telnet, SMTP HTTP. SNMP, FTP. ATM network, ATM Architecture, BISND reference model. ATM applications, Data link control — Line discipline, Flow control, Error control. Encryption — Convention Encryption, Conventional Encryption Model, Steganography, Classical Encryption Techniques, Simplified DES. Block Cipher Design Principles. Block Cipher Modes of Operation.

MODULE-4

Cryptography, Public key encryption and hash functions ,public key cryptography, principles of public key cryptosystems, The RSA algorithm, Message Authentication and Hash functions, Authentication Requirements, Authentication Functions, Message Authentication Codes, MAC Algorithm, Hash Function algorithms, Secure Hash Algorithm, IP Security

MODULE-5
Network Security at various layers, Secure-HTTP. SSL, PSP, authentication Header, Key distribution protocols. Digital Signature, Digital Certificate, Security protocols, Levels of security. Virus and Worms related threats. Malicious programs, firewall. Design principles, Wifi, Bluetooth, Infrared.

Course Outcomes:

CO 1: List the various components of data communication and transmission modes

CO 2: Describe the fundamentals of digital communication and switching.

CO 3: Explain data link layer protocols and network security at various layes.

Suggested Learning Resources:

Books

1. Data Communication‖, 4 th Edition, Behrouz A. Forouzen, Tata McGraw Hill Education,2006
2. Computer Networks‖, 5 th Edition, Andrew S. Tanenbaum, Pearson, 2011
3. William Stallings: Data and Computer Communication, 8th Edition, Pearson Education, 2007.
4. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2007.

Python Lab		Semester	III
Course Code	OBCA305	CIE Marks	30
		SEE Marks	70
Credits	2	Total Marks	100
		Exam Hours	3
Examination nature (SEE)	Lab		

1. Write a program to demonstrate basic data type in python
2. Create a list and perform the following methods
   1) insert() 2) remove() 3) append() 4) len() 5) pop() 6) clear()
3. Create a tuple and perform the following methods
   1) Add items 2) len() 3) check for item in tuple 4)Access items
4. Create a dictionary and apply the following methods
   1) Print the dictionary items 2) access items 3) use get() 4) change values 5) use len()
5. Write a program to create a menu with the following options
   1. TO PERFORM ADDITITON 2. TO PERFORM SUBTRACTION 3. TO PERFORM MULTIPICATION 4. TO PERFORM DIVISION Accepts users input and perform the operation accordingly. Use functions with arguments.
6. Write a python program to print a number is positive/negative using if-else.
7. Write a program for filter() to filter only even numbers from a given list.
8. Write a python program to print date, time for today and now
9. Write a python program to add some days to your present date and print the date added.
10. Write a program to count the numbers of characters in the string and store them in a dictionary data structure
11. Write a program to count frequency of characters in a given file.

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

CO1: Demonstrate the importance of Object Oriented Programming in python

CO2: Experiment the concept of Polymorphism and Inheritance, etc.

CO3: Simulate classes, modules, etc.

Java Programming Lab		Semester	III
Course Code	OBCA306	CIE Marks	30
		SEE Marks	70
Credits	2	Total Marks	100
		Exam Hours	3
Examination nature (SEE)	Lab		

1. a) Write a JAVA program to demonstrate Constructor Overloading and Method Overloading.

b) Write a JAVA program to implement Inner class and demonstrate its Access protection

2. Write a program in Java for String handling which performs the following:

i) Checks the capacity of StringBuffer objects.

ii) Reverses the contents of a string given on console and converts the resultant string in upper case.

iii) Reads a string from console and appends it to the resultant string of (ii).

3. a). Write a JAVA program to demonstrate Inheritance. b). Simple Program on Java for the implementation of Multiple inheritance using interfaces to calculate the area of a rectangle and triangle.

4. Write a JAVA program which has

i) A Class called Account that creates account with 500Rs minimum balance, a deposit()method to deposit amount, a withdraw() method to withdraw amount and also throws LessBalanceException if an account holder tries to withdraw money which makes the balance become less than 500Rs.

ii) A Class called LessBalanceException which returns the statement that says withdraw amount (Rs) is not valid.

iii) A Class which creates 2 accounts, both account deposit money and one account tries to withdraw more money which generates a LessBalanceException take appropriate action for the same.

5. Write a JAVA program using Synchronized Threads, which demonstrates Producer Consumer concept.

6. Complete the following: 1. Create a package named shape. 2.Create some classes in the package representing some common shapes like Square, Triangle, and Circle. 3. Import and compile these classes in other program.
7. Write a JAVA program to create an enumeration Day of Week with seven values SUNDAY through SATURDAY. Add a method isWorkday( ) to the DayofWeek class that returns true if the value on which it is called is MONDAY through FRIDAY. For example, the call DayOfWeek.SUNDAY.isWorkDay ( ) returns false.
8. Write a JAVA program to print a chessboard pattern
9. Write a JAVA program which uses FileInputStream / FileOutPutStream Classes
10. Write JAVA programs which demonstrates utilities of LinkedList Class.
11. Write a JAVA program which uses Datagram Socket for Client Server Communication.
12. Write a JAVA applet program, which handles keyboard event.

Course Outcomes:

CO 1: Demonstrate the object-oriented concepts and JAVA.

CO 2: Experiment programs to solve real world problems in Java.

CO 3: Illustrate simple GUI interfaces for a computer program to interact with users

SEMESTER - IV

Web Programming		**Semester**	**IV**
Course Code	**OBCA401**	**CIE Marks**	**30**
		SEE Marks	**70**
Credits	**4**	**Total Marks**	**100**
		Exam Hours	**3**
Examination nature (SEE)	**Theory**		

Course objectives:

- Explain advanced features of the web programming.
- Define the characteristics of HTML, XHTML, Java script, XML.
- Explore the basic principles of Web programming
- Enhance problem solving and programming skills in web programming with extensive programming projects.

MODULE-1

Fundamentals of Web: Internet, WWW, Web Browsers, and Web Servers, URLs, MIME, HTTP, Security, The Web Programmers Toolbox. XHTML: Origins and evolution of HTML and XHTML, Basic syntax, Standard XHTML document structure, Basic text markup, Images, Hypertext Links, Lists, Tables.

MODULE-2

HTML and XHTML: Forms, Frames in HTML and XHTML, Syntactic differences between HTML and XHTML. CSS: Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Color, Alignment of text, The Box model, Background images, The and tags, Conflict resolution.

MODULE-3

Java Script: Overview of JavaScript; Object orientation and JavaScript; General syntactic characteristics; Primitives, Operations, and expressions; Screen output and keyboard input; Control statements; Object creation and Modification; Arrays; Functions; Constructor; Pattern matching using expressions; Errors in scripts; Examples

MODULE-4

Java Script and HTML Documents: The JavaScript execution environment; The Document Object Model; Element access in JavaScript; Events and event handling; Handling events from the Body elements, Button elements, Text box and Password elements; The DOM 2 event model; The navigator object; DOM tree traversal and modification.

MODULE-5

Dynamic Documents with JavaScript: Introduction to dynamic documents; Positioning elements; Moving elements; Element visibility; Changing colors and fonts; Dynamic content; Stacking elements; Locating the mouse cursor; Reacting to a mouse click; Slow movement of elements; Dragging and dropping elements. XML: Introduction; Syntax; Document structure; Document Type definitions; Namespaces; XML schemas; Displaying raw XML documents; Displaying XML documents with CSS; XSLT style sheets; XML Processors; Web services.

Course Outcomes:

CO 1: Discover HTML and CSS syntax and semantics to build web pages.

CO 2: Demonstrate format tables and forms using HTML and CSS

CO 3: Construct Client-Side Scripts using JavaScript and Server-Side Scripts using PHP to generate and display the contents dynamically.

Suggested Learning Resources:

Books

1. Robert W Sebesta, "Programming the World Wide Web", 4th Edition, Pearson Education, 2008.
2. Web Programming By Chris Bates , Wiley Publications
3. HTML5 Black Book by Dreamtech
4. 4. Angular JS By Krishna Rungta

Introduction to Numpy and Pandas		Semester	IV
Course Code	OBCA402	CIE Marks	30
		SEE Marks	70
Credits	4	Total Marks	100
		Exam Hours	3
Examination nature (SEE)	Theory		

Course objectives:

- **Explore the basic concepts of IPython and Jupyter**
- **Interpret computational environments for scientists using Python, NumPy**
- Explain the Data manipulation with pandas
- Define the working with data sets

MODULE-1

IPython: Beyond Normal Python: Help and Documentation in IPython, Keyboard Shortcuts in the IPython Shell, IPython Magic Commands, Input and Output History, IPython and Shell Commands, Errors and Debugging.

MODULE-2

Introduction to NumPy: Understanding Data Types in Python, The Basics of NumPy Arrays, Computation on NumPy Arrays: Universal Functions, Aggregations: Min, Max, and Everything In Between.

MODULE-3

Computation on Arrays: Broadcasting,Comparisons, Masks, and Boolean Logic,Fancy Indexing, Sorting Arrays, Structured Data: NumPy's Structured Arrays

MODULE-4

Data Manipulation with Pandas: Introducing Pandas Objects, Data Indexing and Selection, Operating on Data in Pandas, Handling Missing Data, Hierarchical Indexing

MODULE-5

Combining Datasets: Concat and Append, Combining Datasets: Merge and Join, Aggregation and Grouping, Pivot Tables, Vectorized String Operations, Working with Time Series, High-Performance Pandas: eval() and query(),Further Resources.

Course Outcomes:

CO 1: Describe the working of Ipython

CO 2: Summarize the application using NumPy and Array

CO 3: Apply the application for using Pandas and datasets

Suggested Learning Resources:

Books

1. Python Data Science Handbook by *Jake Vander Plas*
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd edition,Updated for Python Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/thinkpython/)
3. Guido van Rossum and Fred L. Drake Jr, —An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.
4. Shai Vaingast, "Beginning Python Visualization Crafting Visual Transformation Scripts", Apress, 2nd edition, 2014. 6. Wes Mc Kinney, "Python for Data Analysis", O'Reilly Media, 2012.

Software Engineering		**Semester**	**IV**
Course Code	**OBCA403**	**CIE Marks**	**30**
		SEE Marks	**70**
Credits	**4**	**Total Marks**	**100**
		Exam Hours	**3**
Examination nature (SEE)	**Theory**		

Course objectives:

- Use modern tool to create dynamic diagrams to represent the design for the given problem.
- Draw class diagram , analyse the different types of association that exists as per the given problem and represent them using UML notations.
- Analyse the given system to identify actors, use cases to design use case diagrams for the given problem using RSA/open source tool.
- Design the static/dynamic models to meet application requirements of the given system and generate code (skeleton) using the modern tool.

MODULE-1

Introduction: Software Products and Software process, Process models: Waterfall modal, Evolutionary Development, Bohemia's Spiral model, Overview of risk management, Process Visibility, Professional responsibility. Computer based System Engineering: Systems and their environment, System Procurement, System Engineering Process, System architecture modelling. Human Factors, System reliability Engineering.

MODULE-2

Requirements and Specification: The requirement Engineering Process, The Software requirement document, Validation of Evolution of requirements, Viewpoint – oriented & method based analysis , system contexts , Social 7 organizational factors . Data flow , Semantic, Objects, models , Requirement Specification, Non functional requirement.

MODULE-3

Software Prototyping: Prototyping in software process, Prototyping techniques, User interface prototyping. Software Design: Design Process, Design Strategies, Design Quality, System Structuring control models, Modular decomposition, Domain Specific architecture.

MODULE-4

Object Oriented& function oriented design: Objects, object Classes and inheritance Object identification, An object oriented design example, Concurrent Objects, Data flow design Structural decomposition, Detailed Design, A Comparison of design Strategies. User interface design: Design Principles, User System interaction, Information Presentation, User Guidance, Interface Evaluation.

MODULE-5
Software Verification and Validation : The testing Process , Test Planning & Strategies, Black Box , Structural, interface testing , Program inspections , Mathematically based verification, Static analysis tools, Clean room software development. Management Issues: Project management, Quality management, Software cost estimation, Software maintenance.

Course outcomes:

CO 1: Describe a software system, component, or process to meet desired needs within realistic constraints.

CO 2: Compare professional and ethical responsibility'

CO 3: Apply the techniques, skills, and modern engineering tools necessary for engineering practice, design, implement, verify, validate, implement, and maintain software systems or parts of software systems

Suggested Learning Resources:

Books

1. Ian Sommerville: Software Engineering, 9th Edition, Pearson Education, 2012.

2. Michael Blaha, James Rumbaugh: Object Oriented Modelling and Design with UML,2nd Edition, Pearson Education,2005.
3. Roger S. Pressman: Software Engineering-A Practitioners approach, 7th Edition, Tata McGraw Hill.
4. Stephan R. Schach, "Object oriented software engineering", Tata McGrawHill,2008

Introduction to Artificial Intelligence		Semester	IV
Course Code:	**OBCA404**	**CIE+SEE Marks**	**30 +70=100**
Credits	**04**	**Exam Hours**	**03**
Examination type (SEE)		**Theory**	

Course Objectives:

CLO 1. Illustrate the reasoning on Uncertain Knowledge

CLO 2. Explore the explanation-based learning in solving AI problems

CLO 3. To explore advanced career opportunities

CLO 4. Demonstrate the applications of soft computing and Evolutionary Computing algorithms

Module-1

Artificial Intelligence – Basics, The AI Problems – The Underlying Assumption – What is an AI technique – Criteria for Success. Problems, Problem Spaces and Search – Defining Problem as a State Space Search – Production Systems – Problem Characteristics – Production System Characteristics – Issues in the design of Search Programs.

Module-2

Heuristic Search Techniques - Generate – and – Test – Hill Climbing – Best-First Search – Problem Reduction – Constraint Satisfaction - Means - Ends Analysis. Knowledge Representation issues – Representations and Mapping - Approaches to knowledge Representation.

Module-3

Issues in knowledge Representation – The Frame Problem. Case study based on search algorithms.

Using Predicate Logic – Representing simple facts in Logic – Representing Instance and Isa Relationship – Computable Functions and Predicates – Resolution – Natural Deduction. Representing Knowledge Using Rules – Procedural versus Declarative knowledge.

Module-4

Logic Programming – Forward versus Backward Reasoning – Matching – Control Knowledge. Case study based on reasoning

Reasoning under Uncertainty – Introduction to Non-monotonic Reasoning – Augmenting a Problem Solver – Implementation: Depth - First Search, Fuzzy Logic.

Module-5

Game Playing - The Minimax Search Procedure – Adding Alpha-Beta Cut-offs. Applications of artificial intelligence- Case study on social networks using neural networks, DNA sequencing using AI techniques.

Textbooks / References:

1. Artificial Intelligence (Second Edition) – Elaine Rich, Kevin knight (Tata McGraw-Hill)

2. A Guide to Expert Systems – Donald A. Waterman (Addison-Wesley)

3. Principles of Artificial Intelligence – Nils J. Nilsson (Narosa Publishing House)

4. Introduction to Artificial Intelligence – Eugene Charnaik, Drew McDermott (Pearson Education Asia)

Course Outcomes

Cos	Description
CO1	To be aware of the basics of AI and its need along with the issues in designing search problems.
CO2	Understand and apply various search algorithms in real world problems.
CO3	To get a thorough idea about the fundamentals of knowledge representation, inference and theorem proving.
CO4	Express and comprehend the working knowledge of reasoning in the presence of incomplete and/or uncertain information.
CO5	To gain the aptitude to apply knowledge representation and reasoning to real-world problems

CO-PO Mapping:

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	1					2	1	1	2
CO2	2	1	1			1		2	2	1	1	2
CO3	3	2	1	1					2	1		2
CO4	1	2	1	1		1	1	2	1	1	1	2
CO5	2	1	1	1			1	2	1	1	1	2

Web Lab		Semester	IV
Course Code	OBCA405	CIE Marks	30
		SEE Marks	70
Credits	2	Total Marks	100
		Exam Hours	3
Examination nature (SEE)	Lab		

1. Create a Web page by making use of the following tags : Headers, Linking and Images.
2. Create a Web page that will have the following: Frames, Unordered Lists, Nested and ordered Lists
3. Create a Web page Layout with Tables and all its attributes
4. Create a Web page that will have Application form (Forms) , make use of Image Maps and Tags
5. Create an External Style Sheet that defines the style for the following tag : H1, H2, Body , P, Li .
6. Create an Internal Style Sheet that defines a style for Positioning elements & setting the background (color / image)
7. Create a Style Sheets that defines the style with class method , Id method , make use of DIV and Span TAG
8. Write a JavaScript program to Demonstrate the use of Variable , message box , and loops
9. Write a JavaScript Program to demonstrate Functions (predefined / user defined)
10. Write a JavaScript program to demonstrate Event Handling
11. Object Creation and modification in JavaScript
12. Write a PHP program to demonstrate GET and POST method of passing the data between pages

Course Outcomes:

CO 1: Illustrate HTML and CSS syntax and semantics to build web pages.

CO 2: Demonstrate format tables and forms using HTML and CSS

CO 3: Experiment Client-Side Scripts using JavaScript and Server-Side Scripts using PHP to generate and display the contents dynamically.

Programming Lab Using Python - Numpy and Pandas		Semester	IV
Course Code	OBCA406	CIE Marks	30
		SEE Marks	70
Credits	2	Total Marks	100
		Exam Hours	3
Examination nature (SEE)	Lab		

1. Implement a python program to demonstrate the following using NumPy a) Array manipulation, Searching, Sorting and splitting. b) broadcasting and Plotting NumPy arrays
2. Implement a python program to demonstrate Data visualization with various Types of Graphs using Numpy
3. Write a Python program that creates a mxn integer array and Prints its attributes using matplotlib
4. Write a Python program to demonstrate the generation of linear regression models.
5. Write a Python program to demonstrate the generation of logistic regression models using
6. Write a Python program to demonstrate Time series analysis with Pandas.

Course Outcomes:

CO 1: Demonstrate the working of Ipython with the applications of NumPy and array
CO 2: Illustrate the application for using Pandas and datasets

Computer System & Network Security		Semester	V
Course Code	**OBCA501**	CIE Marks	**30**
Teaching Hours/Week (L:T:P: S)		SEE Marks	**70**
Total Hours of Pedagogy		Total Marks	**100**
Credits	4	Exam Hours	**3**
Examination nature (SEE)	Theory		

Course objectives:

1. To understand basics of Network Security.
2. To be able to secure a message over insecure channel by various means.
3. To learn about how to maintain the Confidentiality, Integrity and Availability of a data.
4. To understand various protocols for network security to protect against the threats in the networks.

MODULE-1

Introduction: Attack, Services and Mechanism, Model for Internetwork Security. Cryptography: Notion of Plain Text, Encryption, Key, Cipher Text, Decryption and cryptanalysis; Public Key Encryption, digital Signatures and Authentication.

MODULE-2

Network Security: Authentication Application: Kerveros, X.509, Directory Authentication Service, Pretty Good Privacy, S/Mime

MODULE-3

IP security Architecture: Overview, Authentication header, Encapsulating Security Pay Load combining Security Associations, Key Management.

MODULE-4

Web Security: Requirement, Secure Socket Layer, Transport Layer Security, and Secure Electronic Transactions.

MODULE-5

Network Management Security: Overview of SNMP Architecutre-SMMPVI1 Communication Facility, SNMPV3. **System Security:** Intruders, Viruses and Relate Threats, Firewall Design Principles. Comprehensive examples using available software platforms/case tools, Configuration Management.

Suggested Learning Resources:

Books

1. W. Stallings, Networks Security Essentials: Application & Standards, Pearson Education, 2000.
2. W.Stallings, Cryptography and Network Security, Principles and Practice, Pearson Education, 2000.

Machine Learning		Semester	V
Course Code	**OBCA502**	CIE Marks	**30**
Teaching Hours/Week (L:T:P: S)		SEE Marks	**70**
Total Hours of Pedagogy		Total Marks	**100**
Credits	4	Exam Hours	**3**
Examination nature (SEE)	Theory		

Course objectives:

1. Explain the concept of supervised, unsupervised and semi-supervised learning.
2. Develop algorithms to learn linear and non- linear models using software.
3. Perform creative work in the field ML to solve given problem.

MODULE-1

Introduction to Machine learning: Supervised learning, Unsupervised learning, some basic concepts in machine learning, Review of probability, The log-sum-exp trick, Feature selection using mutual information, Linear Regression

MODULE-2

Computational Learning theory- Sample complexity, ε- exhausted version space, PAC learning, agnostic learner, VC dimensions, Sample complexity. Bayesian Learning, curse of dimensionality, over fitting. Parametric Estimators - estimator bias and variance, active learning

MODULE-3

Dimensionality reduction, Clustering – choosing the number of clusters, Spectral clustering, Evaluating cluster quality. Margin and generalization (EM) algorithm, EM, regularization

MODULE-4

Non-parametric methods – KNN Linear discrimination - Support vector machine (SVM) and kernels, Classification errors, regularization, logistic regression.

MODULE-5

Model selection, Model selection criteria, Description length, feature selection, Combining classifiers, Bagging, boosting, Random Forest. Markov models, Hidden Markov models (HMMs), Bayesian networks, Learning Bayesian networks, Probabilistic inference, Current problems in machine learning.

Suggested Learning Resources: Books

1. Kevin P. Murphey, ―Machine Learning, a probabilistic perspective‖, The MIT Press, 2012.
2. Tom Mitchael, ―Machine Learning‖, McGraw Hill, 1997.
3. Ethem Alpaydin,‖Introduction to Machine learning‖, PHI learning, MIT Press, 2010, 2nd edition
4. John D. Killeher, Brian Mac, Namee, AoiFE D'Arcy, Fundamental of Machine Learning for Predictive Data Analytics, 2015 MITpress
5. Alex Smola and SVN. Viswanathan, ―Introduction to Machine Learning‖, Cambridge University Press, 2008.

Introduction to Data Mining		Semester	V
Course Code	OBCA503	CIE Marks	30
		SEE Marks	70
		Total Marks	100
Credits	4	Exam Hours	30
Examination nature (SEE)	Theory		

Course objectives:

- Define multi-dimensional data models.
- Explain rules related to association, classification and clustering analysis.
- Compare and contrast between different classification and clustering algorithms

MODULE-1

Data warehousing and OLAP Data Warehouse basic concepts, Data Warehouse Modeling, Data Cube and OLAP : Characteristics of OLAP systems, Multidimensional view and Data cube, Data Cube Implementations, Data Cube operations, Implementation of OLAP and overview on OLAP Software.

MODULE-2

Data Mining and its Applications Introduction, What is Data Mining, Motivating Challenges, Data Mining Tasks, Which technologies are used for data mining, Kinds of pattern that can be mined, Data Mining Applications, Data Preprocessing, Data cleaning, data integration, data reduction and data transformation.

MODULE-3

Association Analysis: Basic Concepts and Algorithms Frequent Item set Generation, Rule Generation, Compact Representation of Frequent Item sets, Alternative methods for generating Frequent Item sets, FP Growth Algorithm, Evaluation of Association Patterns

MODULE-4

Classification : Methods, Improving accuracy of classification Basics, General approach to solve classification problem, Decision Trees, Rule Based Classifiers, Nearest Neighbor Classifiers. Bayesian Classifiers, Estimating Predictive accuracy of classification methods, Improving accuracy of classification methods, Evaluation criteria for classification methods, Multiclass Problem.

MODULE-5

Clustering Techniques Overview, Features of cluster analysis, Types of Data and Computing Distance, Types of Cluster Analysis Methods, Partition Methods, Hierarchical Methods, Density Based Methods, Quality and Validity of Cluster Analysis

Course outcomes:

CO 1: Identify data mining problems and implement the data warehouse

CO 2: Explain association rules for a given data pattern.

CO 3: Simulate between classification and clustering solution

Suggested Learning Resources:

Books

1. Jiawei Han, Micheline Kamber and Jian Pei, —Data mining concepts and Techniques, Third Edition, Elsevier Publisher, 2006.
2. K.P.Soman, Shyam Diwakar and V.Ajay, —Insight into data mining Theory and Practice, Prentice Hall of India, 2006.
3. M. Kantardzic, "Data mining: Concepts, models, methods and algorithms, John Wiley &Sons Inc.
4. PaulrajPonnian, "Data Warehousing Fundamentals", John Willey.

Big Data Analytics		Semester	V
Course Code	**OBCA504**	CIE Marks	**30**
Teaching Hours/Week (L:T:P: S)		SEE Marks	**70**
Total Hours of Pedagogy		Total Marks	**100**
Credits	4	Exam Hours	**3**
Examination nature (SEE)	Theory		

Course objectives:

- The main objective of this course is to make students comfortable with tools and techniques required in handling large amounts of datasets. They will also uncover various terminologies and techniques used in Big Data. Several tools publicly available will be used to illustrate the application of these techniques.

MODULE-1

Introduction to Big Data: What is big data, why big data, the convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open-source technologies, cloud and big data, mobile business intelligence, Crowd-sourcing analytics, inter and trans firewall analytics.

MODULE-2

No SQL: Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schema less databases, materialized views, distribution models, sharding, masterslave replication, peer-peer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map-reduce calculations.

MODULE-3

Hadoop: Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures.

MODULE-4

MapReduce: MapReduce workflows, unit tests with MRUnit, test data and local tests, anatomy of MapReduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats.

MODULE-5
Recent Trends in Big Data Analytics: HBase, data model and implementations, HBase clients, HBase examples, praxis. Cassandra, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration, Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveQL queries.
Suggested Learning Resources: **Books** 1. Seema Acharya, Subhasini Chellappan, "Big Data Analytics", Wiley, 2015 2. Frank J Ohlhorst, —Big Data and Analytics: Turning Big Data into Big Money, Wiley and SAS Business Series, 2012. 3. Tom White, — Hadoop: The Definitive Guide Third Edition, O'reily Media, 2012.

ML Lab		Semester	V
Course Code	OBCA505	CIE Marks	30
Teaching Hours/Week (L:T:P: S)		SEE Marks	70
Total Hours of Pedagogy		Total Marks	100
Credits	2	Exam Hours	3
Examination nature (SEE)	Lab		

Logistic regression, Estimation, Dimensionality reduction

Evaluation measures

- Supervised Learning
  - Find-s algorithm
  - Candidate elimination algorithm- algorithm implementation
  - Naïve Bayes algorithm- algorithm implementation
  - Decision tree algorithm
  - Nearest Neighbor algorithm- algorithm implementation
  - SVM algorithm- using simulation tool
- Unsupervised Learning

  K means algorithm - algorithm implementation
  - EM algorithm
  - HMM

  Instance based learning
  - Locally weighted regression algorithm

Mini Project		Semester	V
Course Code	OBCA506	CIE Marks	30
Teaching Hours/Week (L:T:P: S)		SEE Marks	70
Total Hours of Pedagogy		Total Marks	100
Credits	2	Exam Hours	3
Examination nature (SEE)	Lab		

Data Scientists, employ techniques and theories drawn from many fields within the broad areas of mathematics, statistics, information science, and computer science, in particular from the sub domains of machine learning, classification, cluster analysis, data mining, databases, and visualization to derive actionable insights and help meet specific business needs and goals.

The goal of this Mini Project course is to help the student apply the theories and important tools they studied in this program to practice data science and mobilize the students for the next semester Major Project.

Cloud Computing		Semester	VI
Course Code	OBCA601	CIE Marks	30
Teaching Hours/Week (L:T:P: S)		SEE Marks	70
Total Hours of Pedagogy		Total Marks	100
Credits	4	Exam Hours	3
Examination nature (SEE)	Theory		

Course objectives:

1. Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing
2. Apply the fundamental concepts in data centres to understand the tradeoffs in power, efficiency and cost
3. Discuss system virtualization and outline its role in enabling the cloud computing system model
4. Illustrate the fundamental concepts of cloud storage and demonstrate their use in storage systems such as Amazon S3

MODULE-1

Introduction to Cloud Computing: Eras of computing, The vision of Cloud Computing, Defining a cloud, A closer look, Cloud computing reference model, Historical developments: Distributed systems, Virtualization, Web 2.0; Service oriented computing; Utility oriented computing.

MODULE-2

Architectures for parallel and distributed computing: Parallel Vs Distributed computing, Elements of distributed computing, Technologies for distributed computing.

MODULE-3

Virtualization: Introduction, Characteristics of virtualized environments, Taxonomy of virtualization techniques, Virtualization and cloud computing, Pros and cons of virtualization, Technology examples: Xen: Para virtualization, VmWare: Full virtualization, Microsoft Hyper – V.

MODULE-4

Cloud computing architecture: Introduction, Cloud reference model: Architecture, IaaS, PaaS, SaaS, Types of Clouds: Public, Private, Hybrid and Community clouds, Economics of the cloud, Open challenges.

MODULE-5

Cloud Platforms in Industry: Amazon web services; Google AppEngine; Microsoft Azure; Cloud Applications. Scientific applications: Healthcare; Biology; Geo-Science, Business and Consumer applications: ARM & ERP; Productivity; Social networking

Suggested Learning Resources:

Textbooks :

1. RjkumarBuyya, Christian Vecchiola, and ThamaraiSelci, Mastering Cloud Computing, Tata McGraw Hill, New Delhi, India, 2013

Reference Books

1. Cloud Computing for Dummies by Judith Hurwitz, R.Bloor, M. Kanfman, F.Halper (Wiley India Edition)
2. Cloud Computing: A Practical Approach by J.Vette, Toby J. Vette, Robert Elsenpeter (Tata McGraw Hill)

Course Outcomes

CO1 Demonstrate the fundamental and core concepts of cloud computing
CO2 Compare between parallel and distributed computing
CO3 Investigate the system virtualization and outline its role in enabling the cloud computing system model
CO4 Compare different deployment and service models of cloud to develop different variety of applications

CO-PO Mapping:

PO/ PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	X											
CO2	X	X			X					X		
CO3	X	X										
CO4	X	X	X									

Internship and Seminar		Semester	VI
Course Code	OBCA602	CIE Marks	30
Teaching Hours/Week (L:T:P: S)		SEE Marks	70
Total Hours of Pedagogy		Total Marks	100
Credits	04	Exam Hours	3
Examination nature (SEE)	Lab		

General Rules

1) All the students have to undergo mandatory internship of 4 weeks during the vacation of 5th semester to take up individual project in companies/respective Colleges at higher than the mini project standards already taken up during previous semesters.
2) Internship and seminar shall be considered as a head of passing and shall be considered for the award of degree.
3) Those, who do not take-up/complete the internship shall be declared as fail in internship course and have to complete the same during the subsequent semester.
4) After satisfying the internship requirements the degree will be awarded.
5) The student can present the progress about the internship and seminar to the committee at the department level.
6) The student has to submit a report about the outcome of the internship at the end of the semester along with the project report.
7) The internship and seminar report submitted by the student has to be evaluated by the guide concerned / a committee constituted by the head of the department.
8) The report shall be preserved at the department for future reference.

Project Work		Semester	VI
Course Code	OBCA603	CIE Marks	30
Teaching Hours/Week (L:T:P: S)		SEE Marks	70
Total Hours of Pedagogy		Total Marks	100
Credits	12	Exam Hours	3
Examination nature (SEE)	Lab		

- Project Guide Lines Maximum 2 students shall be allowed to take up a project.
- Each student will have to work for 12 hours per week whether in the college premises or outside.
- If a student opts for industrial outside project, a college teacher has to be an internal guide. In this case the student has to report/present his/her progress twice in a week.
- Guiding one project shall be considered as 4 hours of practical per week as the work load for hte concerned internal guide.
- Each student shall submit his/her project synopsis to the concerned guide within 15 days in consultation with internal guide from the commencement of the respctive semester.
- Each student has to carry out 2 project seminars compulsorily in project duration.
- Each seminar will be considered for thier internal assessment.

Visvesvaraya Technological University, Belagavi

Centre for Distance and Online Education (CDOE), Mysuru

Bachelor of Computer Application in Data Science / Data Analytics

ASSESSMENT GUIDELINES (BOTH CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 30% and for Semester End Exam (SEE) is 70%. The minimum passing marks for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 50% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements (passed) and earned the credits allotted to each course if the student secures not less than 50% in the sum total of the CIE and SEE taken together.

Continuous Internal Evaluation:

The CIE will be for 30 Marks. A candidate shall obtain not less than 50% of the maximum marks prescribed for the CIE. CIE Marks will be based on 30 objective type questions **(MCQ's, Fill in the blanks, one word answer, etc.) from all the Modules. Equal weightage should be given to all the modules.**

Semester End Examination:

The SEE question paper will be set for 70 marks & will have three sections

- **Section-A** consists of 20 objective type questions carrying 1 mark each. All questions are compulsory
- **Section-B** consists of 8 questions carrying 10 marks each. The students will have to answer 5 complete questions

PROGRAMME CO-ORDINATOR
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Visvesvaraya Technological University, Belagavi

Centre for Distance and Online Education (CDOE), Mysuru

VTU-CDOE MYSURU

Bachelor of Computer Applications in Data Science / Data Analytics

PROJECT WORK GUIDELINES

Project Work	Semester	VI	
Course Code	OBCA603 & OBCD603	CIE Marks	30
Teaching Hours/Week (L: P: SDA)	0:4:0	SEE Marks	70
Credits	12	Exam Hours	03

Objective

To expose the students to understand the working of the organization/company/ industry and take up an in-depth study of an issue/problem in the area of specialization.

General guidelines

- Each candidate shall carry out the project work independently as per Scheme of Teaching and Evaluations under the guidance of one of the faculty members of the Department.
- If the project is of inter-disciplinary nature, a co-guide shall be allotted by the University from the other concerned department.
- The topic and title of the dissertation shall be chosen by the candidate in consultation with the guide and co-guide, if any, before the commencement of fourth semester.
- The subject and topic of the dissertation shall be from the major field of studies of the candidate. Modification of only the title but not the field of work may be permitted at the time of final submission of dissertation report during fourth semester.
- The Project Work and Dissertation preparation could be carried out by the students either in their work place/ institution/ any industry/ R&D labs/ business organizations.
- The candidate shall submit a soft copy of the dissertation work to the University.
- The soft copy shall contain the entire Dissertation on the project work in monolithic form as a PDF file (not separate chapters).
- The Guide, after satisfying himself/herself on the suitability of the dissertation and checking the report for completeness and shall upload the Dissertation along with the name, University Seat Number, address, mobile number of the candidate etc., as prescribed in the form available on online Dissertation evaluation portal.

PROGRAMME CO-ORDINATOR
COMPUTER APPLICATIONS
Visvesvaraya Technological University
Centre for Distance and Online Education

- Once the Guide uploads the dissertation, the same shall be linked for plagiarism check. The allowable plagiarism index shall be less than or equal to 25%. If the check indicates a plagiarism index greater than 25%, he/she shall, resubmit the dissertation to the Registrar (Evaluation)/Regional Centre/ Head Office, VTU along with the penal fees.
- By keeping the business trend in the present scenario, university has given an option to the students to select the research problem either from business organization or they can carry out the project on freelance basis subject to the approval of department committee. It is the total responsibility of the internal guide to monitor the freelance project.
- In case, business problem selected from a Company, no two students of an institute shall work on the same problem in the same organization.
- The student shall seek the guidance of the internal guide on a continuous basis, and the guide shall give a certificate to the effect that the candidate has worked satisfactorily under his/her guidance.
- On completion of the project work, student shall prepare a report with the following format.
  i. The Project report shall be prepared using word processor viz. MS Word with New Times Roman, 12 font size and shall be in the A4 size 1" margin on all the sides (1.5 inch on left side) and 1.5 line spacing. The Project report shall not exceed 100 pages.
  ii. The report shall have a title sheet with the title of the project, guide details and month & year of admission.
  iii. A certificate by the guide, Programme Coordinator and the Director indicating the bonafide performance of the project by the student to be enclosed.
  iv. An undertaking by the student to the effect that the work is independently carried out by him/her.
  v. The certificate from the organization if applicable (if its Freelance project, certificate is not required and internal guide can issue a certificate for successful completion).

Project Report Evaluation:

- Internal evaluation will be done by the internal guide.
- External valuation shall be done by faculty members of PG centers of VTU and VTU affiliated institutes with minimum of 10 years experience.
- **Viva-Voce / Presentation:** A viva-voce examination shall be conducted online where a student is expected to give a presentation of his/ her work.
- Minimum passing marks of the Project work is 50% in each of the components such as Internal Marks, report evaluation and viva-voce examination.

PROJECT STRUCTURE

Abstract

Acknowledgement

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CHAPTER 1: INTRODUCTION

1.1 Background

1.2 Objectives

1.3 Purpose, Scope, and Applicability

1.3.1 Purpose

1.3.2 Scope

1.3.3 Applicability

1.4 Achievements

1.5 Organisation of Report

CHAPTER 2: Literature Survey

CHAPTER 3: System Requirements & Specifications

3.1 Functional and Non functional Requirements

3.2 Software and Hardware Tools

3.3 Software Requirements Specification

GLOSSARY APPENDIX A APPENDIX B

Abstract

This should be one/two short paragraphs (400 words), summarising the project work. It is important that this is not just a re-statement of the original project outline. A suggested flow is background, project aims and main achievements.

NOTE: From the abstract, a reader should be able to ascertain if the project is of interest to them and, it should present results of which they may wish to know more details.

Chapter 1: Introduction

The introduction has several parts as given below:

Background:

A description of the background and context of the project and its relation to work already done in the area. Summarise existing work in the area concerned with your project work.

Objectives:

Concise statement of the aims and objectives of the project. Define exactly what you are going to do in the project; the objectives should be about 30 /40 words.

Purpose, Scope and Applicability:

The description of Purpose, Scope, and Applicability are given below:

- **Purpose:**

Description of the topic of your project that answers questions on why you are doing this project. How your project could improve the system its significance and theoretical framework.

- **Scope:**

A brief overview of the methodology, assumptions and limitations.

You should answer the question: What are the main issues you are covering in your project? What are the main functions of your project?

- **Applicability:**

You should explain the direct and indirect applications of your work. Briefly discuss how this project will serve the computer world and people.

Achievements:

Explain what knowledge you achieved after the completion of your work. What contributions has your project made to the chosen area?

Goals achieved - describes the degree to which the findings support the original objectives laid out by the project. The goals may be partially or fully achieved, or exceeded.

Organisation of Report:

Summarising the remaining chapters of the project report, in effect, giving the reader an overview of what is to come in the project report.

Chapter 2: SURVEY OF TECHNOLOGIES

In this chapter

- You should demonstrate your awareness and understanding of Available Technologies related to the topic of your project.
- You should give the detail of all the related technologies that are necessary to complete your project.
- You should describe the technologies available in your chosen area and present a comparative study of all those Available Technologies.
- Explain why you selected the one technology for the completion of the objectives of your project.

Chapter 3: REQUIREMENTS AND ANALYSIS

3.1 Problem Definition:

Formulate/define the problem on which you are working in the project.

Provide details of the overall problem and then divide the problem in to sub- problems. Define each sub-problem clearly.

3.2 Proposed Solution:

Define briefly the methodology/technology you are proposing to solve the problem on which you are working in the project.

3.3 Planning and Scheduling:

Planning and scheduling is a complicated part of software development. Planning, for our purposes, can be thought of as determining all the small tasks that must be carried out in order to accomplish the goal. Planning also takes into account, rules, and known as constraints, which, control when certain tasks can or cannot happen. Scheduling can be thought of as determining whether adequate resources are available to carry out the plan. You should show the Gantt chart and Program Evaluation Review Technique (PERT).

3.4 Software and Hardware Tools used:

Define the details of all the software and hardware needed for the development and implementation of your project.

- Hardware Requirement: In this section, the equipment, graphics card, numeric co-processor, mouse, disk capacity, RAM capacity etc. necessary to run the software must be noted.
- Software Tools used: In this section, the operating system, the compiler, testing tools, linker, and the libraries etc. necessary to compile, link and install the software must be listed.

3.5 Preliminary Product Description:

Identify the requirements and objectives of the new system. Define the functions and operation of the application/system you are developing as your project.

3.6 Conceptual Models:

You should understand the problem domain and produce a model of the system, which describes operations that can be performed on the system, and the allowable sequences of those operations. Conceptual Models could consist of complete Data Flow Diagrams, ER diagrams, Object-oriented diagrams, System Flowcharts etc.

3.7 Software Requirements Specification:

- In this phase you should define the requirements of the system, INDEPENDENT of how these requirements will be accomplished.

- The Requirements Specification describes the things in the system and the actions that can be done on these things.
- Identify the operation and problems of the existing system.

i. USER REQUIREMENTS

ii. SYSTEM REQUIREMENTS

- FUNCTIONAL REQUIREMENTS
- NON-FUNCTIONAL REQUIREMENTS
- DOMAIN REQUIREMENTS

Chapter 4: SYSTEM DESIGN

Describes desired features and operations in detail, including screen layouts, business rules, process diagrams, pseudo code and other documentation.

Basic Modules:

You should follow the divide and conquer theory, so divide the overall problem into more manageable parts and develop each part or module separately. When all modules are ready, you should integrate all the modules into one system. In this phase, you should briefly describe all the modules and the functionality of these modules.

Data Design:

Data design will consist of how you organise, managing and manipulate the data.

- Schema Design: Define the structure and explanation of schemas used in your project.
- Data Integrity and Constraints: Define and explain all the validity checks and constraints you are providing to maintain data integrity.

Procedural Design:

Procedural design is a systematic way for developing algorithms or procedurals.

- **Logic Diagrams:**

Define the systematically flow of procedure that improves its comprehension and helps the programmer during implementation. e.g., Control Flow Chart, Process Diagrams etc.

- **Data Structures:**

Create and define the data structure used in your procedures.

- **Algorithms Design:**

With proper explanations of input data, output data, logic of processes, design and explain the working of algorithms.

User Interface Design:

- Define user, task, environment analysis and how you intend to map those requirements in order to develop a "User Interface".
- Describe the EXTERNAL and INTERNAL components and the architecture of your user interface.
- Show some rough pictorial views of the user interface and its components.

Security Issues:

Discuss Real-time considerations and Security issues related to your project and explain how you intend avoiding those security problems. What are your security policy plans and architecture?

Test Cases Design:

Define test cases, which will provide easy detection of errors and mistakes with in a minimum period of time and with the least effort. Explain the different conditions in which you wish to ensure the correct working of your software.

Chapter 5: IMPLEMENTATION AND TESTING

Implementation Approaches:

Define the plan of implementation, and the standards you have used in the implementation.

Coding Details and Code Efficiency:

Students not need include full source code, instead, include only the important codes (algorithms, applets code, forms code etc). The program code should contain comments needed for explaining the work a piece of code does. Comments may be needed to explain why it does it, or, why it does a particular way.

You can explain the function of the code with a shot of the output screen of that program code.

- **Code Efficiency:** You should explain how your code is efficient and how you have handled code optimisation.

Testing Approach: Testing should be according to the scheme presented in the system design chapter and should follow some suitable model – e.g., category partition, state machine-based. Both functional testing and user-acceptance testing are appropriate. Explain your approach of testing.

- **Unit Testing:**

Unit testing deals with testing a unit or module as a whole. This would test the interaction of many functions but, do confine the test within one module.

- **Integrated Testing:**

Brings all the modules together into a special testing environment, then checks for errors, bugs and interoperability. It deals with tests for the entire application. Application limits and features are tested here.

Modifications and Improvements:

Once you finish the testing you are bound to be faced with bugs, errors and you will need to modify your source code to improve the system. Define what modification you implemented in the system and how it improved your system.

Chapter 6: RESULTS AND DISCUSSION

Test Reports:

Explain the test results and reports based on your test cases, which should show that your software is capable of facing any problematic situation and that it works fine in different conditions. Take the different sample inputs and show the outputs.

User Documentation:

Define the working of the software; explain its different functions, components with screen shots. The user document should provide all the details of your product in such a way that any user reading the manual is able to understand the working and functionality of the document.

Chapter 7: CONCLUSION:

The conclusions can be summarised in a fairly short chapter (2 or 3 pages). This chapter brings together many of the points that you would have made in the other chapters.

Limitations of the System:

Explain the limitations you encountered during the testing of your software that you were not able to modify. List the criticisms you accepted during the demonstrations of your software.

Future Scope of the Project:

It describes two things: firstly, new areas of investigation prompted by developments in this project, and secondly, parts of the current work that was not completed due to time constraints and/or problems encountered.

REFERENCES

It is very important that you acknowledge the work of others that you have used or adapted in your own work, or that provides the essential background or context to your project. The use of references is the standard way to do this. Please follow the given standard for the references for books, journals, and online material.

GLOSSARY

If you use any acronyms, abbreviations, symbols, or uncommon terms in the project report then their meaning should be explained where they first occur. If you go on to use any of them extensively then it is helpful to list them in this section and define the meaning.

APPENDICES

These may be provided to include further details of results, mathematical derivations, certain illustrative parts of the program code (e.g., class interfaces), user documentation etc.

Rubrics for Project Work

Sl. No.	Evaluation Type	Particulars	Marks
1	CIE	Internal Assessment by the Guide- Based on the Presentations by Students	30
2	SEE	Report Evaluation by the Guide & External Examiner. Average of the marks awarded by the two Examiners shall be the final evaluation marks for the Dissertation	35
3	SEE	Viva-Voce Examination to be conducted by the Guide and an External examiner from the Industry/ Institute (Joint Evaluation)	35
Total			100

Rubrics for Project Evaluation and Viva voce Examination

A. Internal Assessment by the Guide- Based on three Presentations by Students

Sl. No.	Aspects	Marks
1	Three Presentations	5
2	Introduction and Methodology	5
3	Industry and Company Profile	5
4	Theoretical background of study	5
5	Data analysis and interpretation	5
6	Summary of findings, suggestions and conclusion	5
Total		30

B. Report Evaluation by the Guide & External Examiner

Sl. No.	Aspects	Marks
1	Introduction & Relevance of the project	5
2	Conceptual background and literature review	5
3	Research design	5
4	Analysis and interpretation	10
5	Summary of findings, suggestions and conclusion	10
Total		35

C. Viva-Voce Examination to be conducted by the Guide and an External examiner from the Industry/ Institute (Joint Evaluation)

Sl. No.	Aspects	Marks
1	Presentation and Communication Skills	5
2	Subject knowledge	5
3	Objectives of the study and Methodology	5
4	Analysis using statistical tools and statistical packages	10
5	Findings and appropriate suggestions	10
Total		**35**

Activity Chart to be followed during Project Work

Activity	Remarks
Identifying the organization and Problem identification	Student individually identifies an organization or identifies problem for his/her study, according to his/her interest.
Problem statement & Research Design	His/ Her interests are discussed with project guides. Discussion with Internal Guide to decide on suitable design for the research
Synopsis Preparation	Preparation of Synopsis* & formulating the objectives
Presentation of Synopsis	The student will present the synopsis with the detailed execution plan to the Internal Guide and Programme Coordinator who will review and may: a. Approve b. Approve with modification or c. Reject for fresh synopsis
Approval Status	The approval status is submitted to Programme Coordinator who will officially give concurrence for the execution of the Project
Understanding Structure, Culture and functions of the organization / Identifying of business problem from the Industry through the literature study	Student should understand products / services and the problems of the organization
Preparation of Research design and Research instrument for data collection	Discussion with the guide for finalization of research design and instrument in his/her domain and present the same to the guide. **(First Presentation)**

Data collection	Date collected to be edited, coded, tabulated and presented to the guide for suggestions for analysis. **(Second Presentation)**
Analysis and finalization of report	Students must use appropriate and latest statistical tools and techniques for analyzing the data. **(Third Presentation)**
Submission of Report	Final Report should be submitted to the University before one week of the commencement of theory examination.

***Synopsis of 3-4 pages to be submitted to the Programme Coordinator through the Guide**

Page 1	Title, Contact Address of student- with details of Internal and External Guide (if applicable)
Pages 2-4	Short introduction with objectives and summary (300 words), Review of Articles / Literature about the topic with source of information.

Formats for Project Report

- Format of Cover Page
- Format of certificate by Company/Institution or from both
- Format of Declaration Page
- Format of Contents
- Format of List of Tables and Charts
- Format of Bibliography

Visvesvaraya Technological University, Belagavi

Centre for Distance and Online Education (CDOE), Mysuru

(Title of the Project Work)

Submitted by

(Student Name)

(USN)

Submitted to

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAVI

In partial fulfillment of the requirements for the award of the degree of

BACHELOR OF COMPUTER APPLICATION IN [DATA SCIENCE / DATA ANALYTICS]

Under the guidance of

INTERNAL GUIDE
(Name & Designation)

EXTERNAL GUIDE
(Name & Designation)

(Institute Logo)

Department of Computer Applications

VTU's Centre for Distance and Online Education

Mysuru

(Month & Year of submission)

Visvesvaraya Technological University, Belagavi

Centre for Distance and Online Education (CDOE), Mysuru

VTU-CDOE MYSURU

CERTIFICATE

This is to certify that (Name of the Student) bearing USN (xxxx), is a bonafide student of Bachelor of computer Application in [Data Science / Data Analytics] course of the Institute (Batch), affiliated to Visvesvaraya Technological University, Belgavi. Project Report on "(Title of Report)"is prepared by him/her under the guidance of (Name of the Guide), in partial fulfilment of the requirements for the award of the degree of Bachelor of computer Application in [Data Science / Data Analytics] of Visvesvaraya Technological University, Belagavi, Karnataka.

Signature of Internal Guide **Signature of PC** **Signature of Director**

VTU-CDOE MYSURU

DECLARATION

I, (Student Name), hereby declare that the Project report entitled "(Title)" with reference to (Organization with place) prepared by me under the guidance of (Guide Name), faculty of Computer Application Department, (Institute name) and external assistance by (External Guide Name, Designation and Organization). I also declare that this Project work is towards the partial fulfilment of the university Regulations for the award of degree of Bachelor of computer Application in [Data Science / Data Analytics] by Visvesvaraya Technological University, Belagavi. I have undergone a summer project for a period of Twelve weeks. I further declare that this Project is based on the original study undertaken by me and has not been submitted for the award of any degree/diploma from any other University / Institution.

Place: **Signature of the Student**

Date:

PROGRAMME CO-ORDINATOR
COMPUTER APPLICATIONS
Visvesvaraya Technological University
Centre for Distance and Online Education
MYSURU-570 029