KKR & KSR INSTITUTE OF TECHNOLOGY AND SCIENCES

(Autonomous)

DEPARTMENT OF CSE - DATA SCIENCE

COURSE STRUCTURE & SYLLABUS
(Regulations – R23)

For B. Tech DEPARTMENT OF CSE - DATA SCIENCE
(Applicable for Batches admitted from 2023-2024)

KKR & KSR INSTITUTE OF TECHNOLOGY AND SCIENCES

(Autonomous)

(Accredited by NBA & NAAC with Grade "A" and Affiliated to JNTUK-Kakinada)
Vinjanampadu, Vatticherukuru Mandal, Guntur-522017.
Andhra Pradesh. INDIA

DEPARTMENT OF CSE - DATA SCIENCE
COURSE STRUCTURE & SYLLABUS – R23

SEMESTER - I

S No	Course Code	Course Title	L	T	P	C	IM	EM	TM
THEORY									
1	23IT1T01	Introduction to Programming	3	0	0	3	30	70	100
2	23SH1T02	Engineering Physics	3	0	0	3	30	70	100
3	23SH1T04	Liner Algebra & Calculus	3	0	0	3	30	70	100
4	23ME1T02	Basic Civil & Mechanical Engineering	3	0	0	3	30	70	100
5	23SH1T01	Communicative English	3	0	0	2	30	70	100
PRACTICAL									
6	23SH1L01	Communicative English Lab	0	0	3	1	30	70	100
7	23EE1L02	Engineering Physics Lab	0	0	3	1	30	70	100
8	23IT1L01	Computer Programming Lab	0	0	3	1.5	30	70	100
9	23ME1L01	Engineering Work Shop	0	0	3	1.5	30	70	100
10	23PC1P01	Health and Wellness , Yoga and Sports	2	0	0	0.5	-	-	-
Total Credits						**19.5**	**270**	**630**	**900**

Theory: BSC-2, ESC-3 **Practical:** BSC-1, ESC-2

SEMESTER - II

S. No	Course Code	Course Title	L	T	P	C	IM	EM	TM
THEORY									
1	23IT2T01	Data Structures	3	0	0	3	30	70	100
2	23SH2T03	Chemistry	3	0	0	3	30	70	100
3	23EE2T01	Basic Electrical And Electronics Engineering	3	0	0	3	30	70	100
4	23SH2T05	Differential Equations & Vector Calculus	3	0	0	3	30	70	100
5	23ME2T01	Engineering Graphics	3	0	0	3	30	70	100
6	23PC2P01	NCC/NSS/Scouts/Community Service	2	0	0	0.5	--	100	100
PRACTICAL									
7	23IT2L02	IT Workshop	0	0	3	1	30	70	100
8	23SH2L03	Chemistry Lab	0	0	3	1	30	70	100
9	20EE2L01	EEE Workshop	0	0	3	1.5	30	70	100
10	23IT2L01	Data Structures Lab	0	0	3	1.5	30	70	100
Total Credits						**20.5**	**270**	**730**	**1000**

Theory: BSC-2, HSMC-1, ESC-2 **Practical:** BSC-1, HSMC-1, ESC-1 MC: 1

DEPARTMENT OF CSE - DATA SCIENCE
COURSE STRUCTURE & SYLLABUS – R23
SEMESTER-III

S. No	Course Code	Course Title	L	T	P	C	IM	EM	TM
THEORY									
1	23SH3T03	Discrete Mathematics for Data Science	3	0	0	3	30	70	100
2	23SH3T01	Universal Human Values – Understanding Harmony And Ethical Human Conduct	3	0	0	3	30	70	100
3	23CD3T01	Python with Data Science	3	0	0	3	30	70	100
4	23CD3T02	Algorithms and Advanced Data Structures	3	0	0	3	30	70	100
5	23CD3T03	Object Oriented Programming Through C++	3	0	0	3	30	70	100
6	23SH3M01	Environmental Science	2	0	0	0	--	--	--
PRACTICAL									
7	23CD3L01	Python with Data Science Lab	0	0	3	1.5	30	70	100
8	23CD3L02	OOPs Through C++ Lab	0	0	3	1.5	30	70	100
9	23CD3S01	Skilled oriented Course 1	0	1	2	2.0	--	50	50
		Total Credits				**20**	**210**	**540**	**750**

Theory: BSC-02,PCC-02,ESC-01: **Practical:** PCC-2,SC-01,MC-01

SEMESTER - IV

S. No	Course Code	Course Title	L	T	P	C	IM	EM	TM
THEORY									
1	23GE4M01	Managerial Economic Financial Analysis	3	0	0	3	30	70	100
2	23SH4T01	Statistical methods for Data Science	3	0	0	3	30	70	100
3	23CD4T01	Data Engineering	3	0	0	3	30	70	100
4	23CD4T02	Database Management Systems	3	0	0	3	30	70	100
5	23CD4T03	Object Oriented Programming Through Java	3	0	0	3	30	70	100
6	23SH4M01	Design Thinking & Innovation	2	0	0	0	--	--	--
PRACTICAL									
7	23CD4L01	DBMS Lab	0	0	3	1.5	30	70	100
8	23CD4L02	OOPs Through Java Lab	0	0	3	1.5	30	70	100
9	23CD4S01	Skilled oriented Course 2	0	1	2	2	15	35	50
		Total Credits				**20**	**225**	**525**	**750**

Theory: MS-01,BSC-01, PCC-3 **Practical:** PCC-02,SC-01

DEPARTMENT OF CSE - DATA SCIENCE

Minor:

To obtain Minor Engineering, *student needs to obtain 18 credits by successfully completing any of the following courses in the concern stream.*

For Minor in AI & ML:

Advanced Data Structures & Algorithm Analysis	3-0-3
1. Artificial Intelligence	3-0-3
2. Operating Systems	3-0-3
3. Computer Networks	3-0-0
4. Machine Learning	3-0-0
5. Deep Learning	3-0-0
6. Cloud computing	3-0-0

For Minor in Cyber Security:

1. Operating Systems	3-0-3
2. Computer Networks	3-0-0
3. Artificial Intelligence	3-0-3
4. Cloud computing	3-0-0
5. Cyber Security	3-0-0
6. Cryptography & Network Security	3-0-3
7. Blockchain technology	3-0-0

For Minor in Data Science:

1. Advanced Data Structures & Algorithm Analysis	3-0-0
2. Artificial Intelligence	3-0-0
3. Introduction to Data Science	3-0-3
4. Machine Learning	3-0-0
5. Data Engineering	3-0-3
6. Big Data Analytics	3-0-0
7. Cloud computing	3-0-0

Honors: Student need to obtain 15 Credits by successfully completing any of the following

1. Social Media Mining	3-0-0
2. Data Storage Mechanisms	3-0-0
3. Graph Analysis for Big Data	3-0-0
4. Business Intelligence and Analytics (MOOCS- SWAYAM / NPTEL 12W)	3-0-0
5. Machine Learning for Engineering and Science Applications	3-0-0
6. (MOOCS- SWAYAM / NPTEL 12W)	
7. Essential of Data Science with R (MOOCS- SWAYAM / NPTEL 12W)	3-0-0
8. Applied Time-Series Analysis (MOOCS- SWAYAM / NPTEL 12W)	3-0-0
9. GPU Architecture and Programming(MOOCS- SWAYAM / NPTEL 12W)	3-0-0
10. Any of the SWAYAM /NPTEL Course suggested by the BoS Chairman	

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - III

Course Code	Course Name	L	T	P	C
23SH3T03	DISCRETE MATHEMATICS FOR DATA SCIENCE	3	0	0	3

Course Objectives:

- To introduce the students to the topics and techniques of discrete methods and combinatorial reasoning.
- To introduce a wide variety of applications. The algorithmic approach to the solution of problems is fundamental in discrete mathematics, and this approach reinforces the close ties between this discipline and the area of computer science

Course Outcomes:

At the end of the Course, the student will be able to

CO1: Build skills in solving mathematical problems (L3)
CO2: Comprehend mathematical principles and logic (L4)
CO3: Demonstrate knowledge of mathematical modeling and proficiency in using mathematical software (L6)
CO4: Manipulate and analyze data numerically and/or graphicallysing appropriate Software (L3)
CO5: How to communicate effectively mathematical ideas/results verbally or in writing (L1)

UNIT I : : Mathematical Logic:

Propositional Calculus: Statements and Notations ,Connectives, Types of Propositions, Statement formulae, Well Formed Formulas, Truth Tables, Tautologies, Contradictions, Contingency, Equivalence of Formulas, Duality Law, Tautological Implications, Normal Forms

UNIT II : Theory of Inference for Statement Calculus

Consistency of Premises, Indirect Method of Proof
Predicate Calculus : Predicates, Predicative Logic, Statement functions, Variables and Quantifiers, Free and Bound Variables, Inference theory for Predicate calculus

UNIT III : Set Theory

Sets: Operations on Sets, **Relations:** Types of relations, Properties, Operations, Equivalence, Compatibility and Partial Ordering, Hasse diagrams, Functions : Types of functions, Bijective, Composite, Inverse, Permutation Functions.

UNIT IV : Recurrence Relations
Generating Functions, Function of Sequences, Calculating Coefficient of Generating Functions, Recurrence Relations, Formulation as Recurrence Relations, Solving Recurrence Relations by Substitution and Generating Functions, Method of Characteristics.

UNIT V : Graph Theory

Basic Concepts, Graph Theory and its Applications, Sub graphs, Graph Representations: Adjacency and Incidence Matrices, Isomorphic Graphs, Paths and Circuits, Eulerian and Hamiltonian Graphs, Multi graphs, Bipartite and Planar Graphs, Euler's Theorem(Without Proof) Graph spanning Trees Prim's and Kruskal's Algorithms..

Text Books:

1. Discrete Mathematical Structures with Applications to Computer Science, J. P. Tremblay and P. Manohar, Tata McGraw Hill.
2. Elements of Discrete Mathematics-A Computer Oriented Approach, C. L.Liu and D. P. Mohapatra, 3rd Edition, Tata McGraw Hill.
3. Theory and Problems of Discrete Mathematics, Schaum's Outline Series, Seymour Lipschutz and Marc Lars Lipson, 3rd Edition, McGraw Hill

Reference Books:

1. Discrete Mathematics for Computer Scientists and Mathematicians, J. L.Mott, A. Kandel and T. P. Baker, 2nd Edition, Prentice Hall of India.
2. Discrete Mathematical Structures, Bernand Kolman, Robert C. Busby andSharon Cutler Ross, PHI.
3. Discrete Mathematics, S. K. Chakraborthy and B.K. Sarkar, Oxford, 2011.
4. Discrete Mathematics and its Applications with Combinatorics and GraphTheory, K. H. Rosen, 7th Edition, Tata McGraw Hill.

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SEMESTER - III

Course Code	Course Name	L	T	P	C
23SH3T01	UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY AND ETHICAL HUMAN CONDUCT	3	0	0	3

Course Objectives:

1. To help the students appreciate the essential complementary between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature

Course Outcomes:

At the end of the Course, the student will be able to

1. Define the terms like Natural Acceptance, Happiness and Prosperity (L1, L2)
2. Identify one's self, and one's surroundings (family, society nature) (L1, L2)
3. Apply what they have learnt to their own self in different day-to-day settings in real life (L3)
4. Relate human values with human relationship and human society. (L4)
5. Justify the need for universal human values and harmonious existence (L5)
6. Develop as socially and ecologically responsible engineers (L3, L6)

Course Topics

The course has 28 lectures and 14 tutorials in 5 modules. The lectures and tutorials are of 1-hour duration. Tutorial sessions are to be used to explore and practice what has been proposed during the lecture sessions.

The Teacher's Manual provides the outline for lectures as well as practice sessions. The teacher is expected to present the issues to be discussed as propositions and encourage the students to have a dialogue.

UNIT I : - Introduction to Value Education

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education), Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity, Method to Fulfil the Basic Human Aspirations

UNIT II : - Harmony in the Human Being

Understanding Human being as the Co-existence of the self and the body, Distinguishing between the Needs of the self and the body, Harmony of the self with the body, Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Health.

UNIT III : Harmony in the Family and Society

Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, Understanding the meaning of Respect, Difference between respect and differentiation, the other salient values in relationship, Understanding Harmony in the Society.

UNIT IV : Harmony in the Nature/Existence

Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence.

UNIT V : Implications of the Holistic Understanding – a Look at Professional Ethics

Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Production Systems and Management Models

Text Books:

1. R R Gaur, R Asthana, G P Bagaria, A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1

b. The Teacher's Manual

2. R R Gaur, R Asthana, G P Bagaria, Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books:

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

Mode of Conduct :

1. Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them.
2. In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self- exploration.
3. Scenarios may be used to initiate discussion. The student is encouraged to take up "ordinary" situations rather than" extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

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SEMESTER - III

Course Code	Course Name	L	T	P	C
23CD3T01	PYTHON WITH DATA SCIENCE	3	0	0	3

Course Objectives:

1. To learn about Python programming language syntax, semantics, and the runtime environment
2. To be familiarized with universal computer programming concepts like data types, containers
3. To be familiarized with general computer programming concepts like conditional execution, loops & functions
4. To be familiarized with general coding techniques and object-oriented programming

Course Outcomes:

1. Develop essential programming skills in computer programming concepts like data types, containers
2. Apply the basics of programming in the Python language
3. Solve coding tasks related conditional execution, loops
4. Solve coding tasks related to the fundamental notions and techniques used in object-oriented programming.
5. Apply principles of NumPy and Pandas to the analysis of data.

UNIT I

Introduction: Introduction to Python, Displaying Output with the Print Function, Comments, Variables, Reading Input from the Keyboard, Operators. Type conversions, Expressions.

Data Types, and Expression: Strings Assignment, Comparing Strings, Numeric Data Types

Decision Structures and Boolean Logic: if, if-else, if-elif-else Statements, Nested Decision Structures.

UNIT II

Repetition Structures: Introduction, while loop, for loop, Nested Loops.

Strings and Text Files: String Methods TextFiles. Understanding read functions, read(), readline() and readlines(), Understanding write functions, write() and writelines(),

List and Dictionaries: Lists, tuple, Dictionaries and sets, frozen sets.

UNIT III

Design with Function: Defining Simple Functions, Functions as Abstraction Mechanisms, Design with Recursive Functions

Modules: Modules, Standard Modules, Packages.

Object Oriented Programming: Concept of class, object and instances, Constructor, class attributes and destructors, Inheritance, overloading operators, Programming using Oops support. Exception handling mechanism.

UNIT IV

Data Science: Definition, Exploratory Data Analysis, Role of Data scientist.

NumPy Basics: The NumPy ndarray: A Multidimensional Array Object, Creating ndarrays ,Data Types for ndarrays, Operations between Arrays and Scalars, Basic Indexing and Slicing, Boolean Indexing, Fancy Indexing, Data Processing Using Arrays, Expressing Conditional Logic as Array Operations, Methods for Boolean Arrays , Sorting , Unique.

UNIT V

Getting Started with pandas: Introduction to pandas, Library Architecture, Features, Applications, Data Structures, Series, Data Frame, Index Objects, Essential Functionality Re indexing, Dropping entries from an axis, Indexing, selection, and filtering),Sorting and ranking, Summarizing and Computing Descriptive Statistics, Unique Values, Value Counts, Handling Missing Data, filtering out missing data.

Text Books:

1. Fundamentals of Python First Programs, Kenneth. A. Lambert,Cengage.
2. Python Programming: A Modern Approach, VamsiKurama,Pearson.
3. ReemaThareja, Python Programming using problem solving Approach, Oxford University Press 2017
4. R. NageswaraRao core python Programming second Edition.
5. Wes McKinney, "Python for Data Analysis", O'REILLY, ISBN:978-1-449-31979-3, 1st edition, October 2012.
6. Rachel Schutt & O'neil, "Doing Data Science", O'REILLY, ISBN:978-1-449-35865-5, 1st edition, October 2013

Reference Books:

4. Introduction to Python Programming, Gowrishankar.S, VeenaA, CRC Press.
5. Introduction to Programming Using Python, Y. Daniel Liang, Pearson.
6. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media, 2015
7. Matt Harrison, "Learning the Pandas Library: Python Tools for Data Munging, Analysis, and Visualization , O'Reilly, 2016

E - Resources:

1. https://www.tutorialspoint.com/python3/python_tutorial.pdf
2. https://bugs.python.org/file47781/Tutorial_EDIT.pdf

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - III

Course Code	Course Name	L	T	P	C
23CD3T02	ALGORITHMS AND ADVANCED DATA STRUCTURES	3	0	0	3

Course Outcomes:

CO1: provide knowledge on advanced trees and asymptotic notations used for denoting performance of algorithms
CO2: Solve problems using Heap trees, Graphs, divide and conquer, greedy, dynamic programming, backtracking and branch and bound algorithmic approaches.
CO3: Solve the problems using Greedy and dynamic programming.
CO4: Solve the problems using back tracking and branch and bound
CO5: Demonstrate an understanding of NP- Completeness theory and lower bound theory.

UNIT I

Introduction, Asymptotic Notations, Splay trees, AVL Trees – Creation, Insertion, Deletion operations and Applications, B-Trees – Creation, Insertion, Deletion operations and Applications.

UNIT II

Heap Trees (Priority Queues) – Min and Max Heaps, Operations and Applications, Graphs – Terminology, Representations, Graph Traversals, Minimum spanning trees – prims algorithm, krushkal algorithm.

Divide and Conquer: General Method, Defective chessboard, finding the maximum and minimum, Quick sort.

UNIT III

The Greedy Method: The general Method, knapsack problem, Job sequencing with deadlines, Single Source Shortest path (Dijkstras Algorithm).

Dynamic Programming: General Method, All pairs shortest paths, Single Source Shortest Paths – General Weights (Bellman Ford Algorithm), 0/1 Knapsack, Travelling Salesperson problem

UNIT IV

Backtracking: The General Method, The 8-Queens problem, sum of subsets, Graph coloring, Hamiltonian cycles.

Branch and Bound: FIFO Branch-and-Bound, LC Branch-and-Bound, TSP

UNIT V

NP Hard and NP Complete Problems: NP Hardness, NP Completeness, Consequences of being in P, Cook's theorem

NP Hard Graph Problems: Reduction Source Problems, Clique Decision Problem (CDP), Chromatic Number Decision Problem (CNDP), Traveling Salesperson Decision Problem (TSP)

Text Books:

1. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", 2nd Edition, Universities Press.
2. Harsh Bhasin, " Algorithms Design & Analysis", Oxford University Press.
3. Fundamentals of Data Structures, Horowitz, Ellis; Sahni, Sartaj; Mehta, Dinesh 2nd Edition Universities Press

Reference Books:

1. Horowitz E. Sahani S: "Fundamentals of Computer Algorithms", 2nd Edition, Golgotha Publications, 2008.
2. 2. S. Sridhar, "Design and Analysis of Algorithms", Oxford University Press
3. 3. Data Structures and program design, Robert Kruse, Pearson Education Asia
4. An introduction to Data Structures with applications, Trembley& Sorenson, McGraw Hill
5. The Art of Computer Programming, Vol.1: Fundamental Algorithms, Donald E Knuth, Addison-Wesley, 1997.

E - Resources:

1. https://www.tutorialspoint.com/advanced_data_structures/index.asp
2. http://peterindia.net/Algorithms.html
3. Abdul Bari,1. Introduction to Algorithms (youtube.com)
4. http://nptel.ac.in/courses/106101060/

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SEMESTER - III

Course Code	Course Name	L	T	P	C
23CD3T03	OBJECT ORIENTED PROGRAMMING THROUGH C++	3	0	0	3

Course Objectives:

1. Describe the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects
2. 2. Understand dynamic memory management techniques using pointers, constructors, destructors
3. 3. Describe the concept of function overloading, operator overloading, virtual functions and polymorphism
4. 4. Classify inheritance with the understanding of early and late binding, usage of exception handling, generic programming
5. 5. Demonstrate the use of various OOPs concepts with the help of programs

Course Outcomes:

1. Classify object oriented programming and procedural programming
2. 2. Apply C++ features such as composition of objects, operator overloads, dynamic
3. memory allocation, inheritance and polymorphism, file I/O, exception handling
4. 3. Build C++ classes using appropriate encapsulation and design principles
5. 4. Apply object oriented or non-object oriented techniques to solve bigger computing problems

UNIT I

Introduction to C++: Differences between C and C++, Evolution of C++, The Object Oriented Technology, Disadvantages of Conventional Programming, Key Concepts of Object Oriented Programming, Advantages of OOP.

UNIT II

Classes and Objects &Constructors and Destructor: Classes in C++, Declaring Objects, Access Specifiers and their Scope, Defining Member Function, Function overloading, Static data member, Static Member functions, inline functions, friend function. **Constructors and Destructors** - definitions, properties of constructors, constructor overloading, Types of constructors - Default, parameterized and copy constructors, destructors.

UNIT III

Operator Overloading and Type Conversion & Inheritance: Introduction, Overloading Unary Operators, Constraint on Increment And Decrement Operators, Overloading Binary Operators, Overloading Assignment Operator (=), Type Conversion, Rules For Overloading Operators, Inheritance, Types of Inheritances- single, multilevel, multiple, hybrid and hierarchical inheritance, Virtual Base Classes, Abstract Classes -, Advantages of Inheritance, Disadvantages of Inheritance.

UNIT IV

Pointers & Binding Polymorphisms and Virtual Functions:

Pointer, Features of Pointers- Pointer Declaration- Pointer to Class- Pointer Object- The this Pointer- Pointer to Derived Classes and Base Class, Binding Polymorphisms and Virtual Functions, Abstract Classes, Introduction- Binding in C++- Virtual Functions- Rules for Virtual Function- Virtual Destructor.

UNIT V

Generic Programming with Templates & Exception Handling: Definition of class Templates, Normal Function Templates, Over Loading of Template Function, Bubble Sort Using Function Templates, Exception Handling, Principles of Exception Handling, The Keywords try, throw, throws, catch, finally.

Text Books:

1. A First Book of C++, Gary Bronson, Cengage Learning.
2. The Complete Reference C++, Herbert Schildt, TMH.

Reference Books:

1. Object Oriented Programming C++, Joyce Farrell, Cengage.
2. C++ Programming: from problem analysis to program design, DS Malik, Cengage Learning
3. Programming in C++, Ashok N Kamthane, Pearson 2nd Edition

DEPARTMENT OF CSE - DATA SCIENCE

SEMESTER - III

Course Code	Course Name	L	T	P	C
23SH3M01	ENVIRONMENTAL SCIENCE	2	0	0	-

Course Objectives:

- To make the students to get awareness on environment
- To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life
- To save earth from the inventions by the engineers

Course Outcomes:

At the end of the Course, the student will be able to

1. Grasp multidisciplinary nature of environmental studies and various renewable and non-renewable resources.
2. Understand flow and bio-geo-chemical cycles and ecological pyramids.
3. Understand various causes of pollution and solid waste management and related preventive measures.
4. About the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation.
5. Casus of population explosion, value education and welfare programmes.

UNIT I

Multidisciplinary Nature Of Environmental Studies: – Definition, Scope and Importance – Need for Public Awareness.

Natural Resources: Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems–Mineral resources :Use and exploitation, environmental effects of extracting and using mineral resources, case studies– Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, casestudies.–Energy resources:

UNIT II

Ecosystems: Concept to fan ecosystem.–Structure and function of an ecosystem–Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids–Introduction, types, characteristic features, structure and function of the following ecosystem:

Forest ecosystem.

Grass land ecosystem,Desert ecosystem
Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)
Biodiversity And Its Conservation: Introduction Definition: genetic, species and ecosystem diversity–Bio-geographical classification of India–Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts– Endangered and endemic species of India –Conservation of biodiversity: In-situand Ex-situ conservation of biodiversity.

UNIT III

Environmental Pollution: Definition, Cause, effects and control measures of:

- Air Pollution.
- Water pollution
- Soil pollution
- Marine pollution
- Noise pollution
- Thermal pollution
- Nuclear hazards

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earth quake, cyclone and landslides.

UNIT IV

Social Issues and the Environment: From Unsustainable to Sustainable development– Urban problems related to energy – Water conservation, rain water harvesting, watershed management –Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions–Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Waste land reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. –Water (Prevention and control of Pollution) Act– Wild life Protection Act–Forest Conservation Act–Issues involved in enforcement of environment allegislation–Public awareness.

UNIT V

Human Population And The Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education–HIV/AIDS–Women and Child Welfare–Role of information Technology in Environment and human health–Case studies. Field Work: Visit to a local area to document environmental assets River/ forest grassland/ hill/ mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds– river, hills lopes, etc..

Text Books:

1) Text book of Environmental Studies for Undergraduate Courses ErachBharucha for University Grants Commission, Universities Press
2) Palaniswamy,"Environmental Studies", Pearson education
3) S.Azeem Unnisa,"Environmental Studies" Academic Publishing Company
4) K.Raghavan Nambiar,"Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus", Scitech Publications (India), Pvt.Ltd.

Reference Books:

1) Deeksha Daveand E.SaiBaba Reddy, "Text book of Environmental Science",Cengage Publications.
2) M.Anji Reddy,"Text book of Environmental Sciences and Technology",BS Publication.
3) J.P.Sharma, Comprehensive Environmental studies, Laxmi publications.
4) J.GlynnHenryandGaryW.Heinke,"Environmental Sciences and Engineering" ,Prentice Hall of India Private limited
5) G.R.Chatwal,"A Text Book of Environmental Studies "Himalaya Publishing House
6) Gilbert M.Masters and WendellP.Ela,"Introduction to Environmental Engineering and Science, Prentice Hall of India Private limited.

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - III

Course Code	Course Name	L	T	P	C
23CD3L01	PYTHON WITH DATA SCIENCE LAB	0	0	3	1.5

Course Objectives:

- The main objective of the course is to inculcate the basic understanding of Data Science and its practical implementation using Python.

Exercise 1:

1) Use a for loop to print a triangle like the one below. Allow the user to specify how high the triangle should be.

*
**
***
****

2. Write a program that asks the user to enter a word and prints out whether that word contains any vowels.
3. Write a program that generates a list of 20 random numbers between 1 and100.

Exercise 2:

1. Print the list.
2. Print the average of the elements in the list.
3. Print the largest and smallest values in the list.
4. Print the second largest and second smallest entries in the list
5. Print how many even numbers are in the list.

Exercise 3:

1. Write a program to use split and join methods in the given string and store them in a dictionary data structure.
2. Write a program that removes any repeated items from a list so that each item appears at most once. For instance, the list [1,1,2,3,4,3,0,0] would become [1,2,3,4,0]

Exercise 4:

1. Write a function called sum_digits that is given an integer num and returns the sum of the digits of num.
2. Write a function called number_of_factors that takes an integer and returns how many factors the number has.
3. Write a function called merge that takes two already sorted lists of possibly different lengths, and merges them into a single sorted list.
   (a) Do this using the sort method.
   (b) Do this without using the sort method

Exercise 5:

1. Creating a NumPy Array
2. The Shape of NumPy Array
3. Reshaping of NumPy Array
4. Transpose of a NumPy array

Exercise 6:

1. Indexing of NumPy Array
2. Slicing of NumPy Array
3. Sorting in NumPy Arrays

Exercise 7:

1. Perform following operations using pandas
2. Creating dataframe
3. concat()
4. Setting conditions
5. Adding a new column

Exercise 8:

Perform following operations using pandas

1. Filling NaN with string
2. Sorting based on column values
3. groupby()

Exercise 9:

Perform following visualizations using matplotlib

1. Bar Graph
2. Pie Chart
3. Box Plot
4. Histogram
5. Line Chart and Subplots
6. Scatter Plot

Web References :

1. https://www.analyticsvidhya.com/blog/2020/04/the-ultimate-numpy-tutorial-for-data-science-beginners/
2. https://www.analyticsvidhya.com/blog/2021/07/data-science-with-pandas-2-minutes-guide-to-key-concepts/
3. https://www.analyticsvidhya.com/blog/2020/04/how-to-read-common-file-formats-python/
4. https://www.analyticsvidhya.com/blog/2016/07/practical-guide-data-preprocessing-python-scikit-learn/
5. https://www.analyticsvidhya.com/blog/2020/02/beginner-guide-matplotlib-data-visualization-exploration-python/6.
   https://www.nltk.org/book/ch01.html

DEPARTMENT OF CSE - DATA SCIENCE

SEMESTER - III

Course Code	Course Name	L	T	P	C
23CD3L02	OBJECT ORIENTED PROGRAMMING THROUGH C++ LAB	0	0	3	1.5

Course Objectives:

1. Demonstrate procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects.
2. Understand dynamic memory management techniques using pointers, constructors, destructors, etc
3. Demonstrate the concept of function overloading, operator overloading, virtual functions and polymorphism, inheritance.

Exercise 1:

1. Program to demonstrate class, object, member function.
2. Program to demonstrate access specifies

Exercise 2:

1. Program to demonstrate inline functions
2. Implement static functions
3. Program to demonstrate friend functions

Exercise 3:

1. Implement function overloading.
2. Implement constructor overloading
3. Program to implement copy constructor

Exercise 4:

1. Implement unary operator overloading
2. Implement binary operator overloading

Exercise 5:

1. Program to demonstrate single level inheritance
2. Program to demonstrate multi level inheritance
3. Program to demonstrate multiple inheritance

Exercise 6:

1. Implement this pointer
2. Program to demonstrate virtual functions
3. Implement pure virtual functions

Exercise 7:

1. Implement bubble sort using function templates
6. Program to demonstrate exception handling mechanism

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - IV

Course Code	Course Name	L	T	P	C
23MC4T01	MANAGERIAL ECONOMICS & FINANCIAL ANALYSIS	3	0	0	3

Course Objectives:

1. The Learning objectives of this paper are to understand the concept and nature of Managerial Economics and its relationship with other disciplines and also to understand the Concept of Demand and Demand forecasting
2. To familiarize about the Production function, Input Output relationship, Cost-Output relationship and Cost-Volume-Profit Analysis
3. To know the different forms of Business organization, the concept of Business Cycles and Methods of Pricing.
4. To learn different Accounting Systems and preparation of Financial Statements to evaluate the financial position of the firm.
5. Finally, to learn the different tools for performance evaluation of business.

Course Outcomes:

1. The Learner is equipped with the knowledge of estimating the Demand and demand elasticities for a product.
2. The knowledge of understanding of the Input-Output-Cost relationships and estimation of the least cost combination of inputs.
3. The pupil is also ready to gain the knowledge of different Business Units, and pricing methods.
4. The Learner is able to prepare Financial Statements.
5. The Learner is able to use various Ratios for Analysis and Interpretation of Business Data

UNIT I

Introduction to Managerial Economics and Demand Analysis:

Definition of Managerial Economics – Scope of Managerial Economics and its relationship with other subjects; Concept of Demand, Types of Demand, Determinants of Demand- Demand schedule, Demand curve, Law of Demand and its limitations- Elasticity of Demand, Types of Elasticity of Demand and Measurement- Demand forecasting and Methods of forecasting; Concept of Supply and Law of Supply.

UNIT II

Theories of Production and Cost Analysis: Production function- Law of Variable proportions- Isoquants and Iso costs and choice of least cost factor combination-Concepts of Returns to scale and Economies of scale- cost concepts –Cost –Volume-Profit analysis-Determination of Breakeven point (simple problems)-Managerial significance and limitations of Breakeven point.

UNIT III

Forms of Business organizations: Features and Evolution of Sole Trader, Partnership, Joint Stock Company – State / Public Enterprises and their forms. Methods of Pricing.

Business Cycles: Meaning and Features –Phases of a Business Cycle

UNIT IV

Introduction to Accounting: Accounting Vs Accountancy; GAAP; Introduction to Double Entry System, Journal, Ledger, Trail Balance and Preparation of Final Accounts with adjustments (Simple Problems)

UNIT V

Financing Analysis – Introduction to Financial analysis - Types of Financial Analysis; Ratio Analysis (Simple Problems)

Text Books:

1. A R Aryasri, Managerial Economics and Financial Analysis, The McGraw – Hill companies

Reference Books:

1. Varshney R.L, K.L Maheswari, Managerial Economics, S. Chand & Company Ltd.
2. JL Pappas and EF Brigham, Managerial Economics, Holt, R & W; New edition
3. N.P Srinivasn and M. Sakthivel Murugan, Accounting for Management, S. Chand & Company
4. Ltd.
5. Maheswari S.N, An Introduction to Accountancy, Vikas Publishing House Pvt Ltd
6. I.M Pandey, Financial Management, Vikas Publishing House Pvt Ltd
7. V. Maheswari, Managerial Economics, S. Chand & Company Ltd.

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - IV

Course Code	Course Name	L	T	P	C
23SH4T01	STATISTICAL METHODS FOR DATA SCIENCE	3	0	0	3

Course Objectives:

- To familiarize the students with the foundations of probability and statistical methods
- To impart probability concepts and statistical methods in various applications Engineering

Course Outcomes:

At the end of the Course, the student will be able to

CO1 : Determine the mean and variance of discrete and continuous random variables.

CO2 : Calculate probabilities using normal distribution and construct sampling distribution of means.

CO3 : Estimate the confidence interval for the mean of a population and test a hypothesis concerning means.

CO4: Estimate the confidence intervals, test a hypothesis concerning variances and proportions.

CO5 : Calculate correlation coefficient and determine line a regression for bivariate data.

Unit I:

Random Variables: Random variables, types of random variables, probability distribution function, probability density function, mean and variance of a random variable

Unit II:

Probability Distributions and Sampling Distributions:

Normal distribution: calculating normal probabilities, normal approximation to the Binomial distribution. Sampling distributions: population and sample, sampling distribution of the mean (known), sampling distribution of the mean (unknown).

Unit III:

Estimation and Test of Hypothesis of Means:

Point estimation, interval estimation, introduction to test of hypothesis, hypotheses is concerning one mean, hypothesis concerning two means, matched pair comparisons.

Unit IV:

Estimation, Test of Hypothesis of Variances and Proportions Estimation of variance, hypothesis concerning one variance, hypothesis concerning two variances, estimation of proportion, hypothecs is concerning one proportion, hypotheses is concerning several proportions.

Unit V:

Regression analysis:

The method of least squares, curvilinear regression, multiple regression, correlation (excluding causation).

Text book:

1. Richard A. Johnson,"*Miller & Freund's Probability and Statistics for Engineers*", 8th edition, PHIL earning India Private Limited, 2011.

Reference Books:

1) S.Ross,"*A First Coursein Probability*", Pearson Education India, 2002.
2) W. Feller, "*An Introduction to Probability Theory and its Applications*", 1st edition, Wiley,1968.
3) Gilbert Strang, "*Introduction to Linear Algebra*", 5thedition, Wellesely- Cambridge Press, 2016.

DEPARTMENT OF CSE - DATA SCIENCE

SEMESTER - IV

Course Code	Course Name	L	T	P	C
23CD4T01	DATA ENGINEERING	3	0	0	3

Course Objectives:

- To introduce about database management systems
- To give a good formal foundation on the relational model of data and usage of Relational Algebra
- To introduce the concepts of basic SQL as a universal Database language
- To demonstrate the principles behind systematic database design approaches by covering conceptualdesign, logical design through normalization
- To provide an overview of physical design of a database system, by discussing Database indexingtechniques and storage techniques

Course Outcomes:

At the end of the Course, the student will be able to

CO1 : Summarize the concepts of Data Engineering

CO2 : Providing knowledge on Data engineering life cycle and security issues

CO3 : Construct a decision tree and resolve the problem of model over fitting

CO4 : Summarize architecture of data warehouse, Apply different preprocessing methods, Similarity, Dissimilarity measures for any given raw data.

CO5 : Construct a decision tree and resolve the problem of model over fitting , Apply suitable clustering algorithm for the given data set

UNIT I

Introduction to Data Engineering: Definition, Data Engineering Versus Data Science, Data Engineering Skills and Activities,

Data Maturity: Data Maturity Model, Skills of a Data Engineer, Business Responsibilities, Technical Responsibilities, Data Engineers and Other Technical Roles.

UNIT II

Data Engineering Life Cycle, Generation: Source System, Storage, Ingestion, Transformation, Serving Data.

Major undercurrents across the Data Engineering Life Cycle: Security, Data Management, DataOps, Data Architecture, Orchestration, Software Engineering.

UNIT III

Data Warehouse and Data Mining: What Is a Data Warehouse? A Multidimensional Data Model, Data Warehouse Architecture, What is Data Mining?, Types of Data.

Data Pre-processing: Aggregation, Sampling, Dimensionality Reduction, Feature Subset Selection, Feature creation, Discretization and Binarization, Variable Transformation, Measures of Similarity and Dissimilarity.

UNIT IV

Classification: Building a decision tree, Methods for expressing an attribute test conditions, Measures for selecting the best split.

Model Over fitting: Evaluating the performance of classifier: holdout method, random sub sampling, cross-validation, bootstrap. Bayes Theorem, Naïve Bayes Classifier.

UNIT V

Cluster Analysis: Basic Concepts and Algorithms: Overview, What Is Cluster Analysis? Different Types of Clusters; K-means: The Basic K-means Algorithm, K-means Additional Issues, Bisecting K-means, Strengths and Weaknesses; Agglomerative Hierarchical Clustering: Basic Agglomerative Hierarchical Clustering Algorithm DBSCAN: Traditional Density Center-Based Approach, DBSCAN Algorithm, Strengths and Weaknesses. (Tan &Vipin).

Text Books:

1) 1. Joe Reis, Matt Housley, Fundamentals of Data Engineering, O'Reilly Media, Inc.,June 2022,ISBN: 9781098108304
2) 2. Introduction to Data Mining : Pang-Ning Tan & Michael Steinbach, Vipin Kumar, Fifth Impression,Pearson, 2015.
3) 3. Data Mining concepts and Techniques, 3rd Edition, Jiawei Han, Michel Kamber, Elsevier, 2011

Reference Books:

1) 1. Paul Crickard , Data Engineering with Python,Packt Publishing, October 2020.
2) 2. Ralph Kimball, Margy Ross, The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling, Wiley, 3rd Edition, 2013
3) 3. James Densmore, Data Pipelines Pocket Reference: Moving and Processing Data for Analytics, O'Reilly Media, 1st Edition, 2021
4) 4. Data Mining Techniques and Applications: An Introduction, Hongbo Du, Cengage Learning, 2010
5) 5. Data Mining : Introductory and Advanced topics : Dunham, First Edition, Pearson, 2020
6) 6. Data Warehousing Data Mining & OLAP, Alex Berson, Stephen Smith, TMH, 2008
7) 7. Data Mining Techniques, Arun K Pujari, Universities Press, 2001

e-Resources:

1) NPTEL Online Course on Data Mining : https://onlinecourses.nptel.ac.in/noc18_cs14/preview

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - IV

Course Code	Course Name	L	T	P	C
23CD4T02	DATABASE MANAGEMENT SYSTEMS	3	0	0	3

Course Objectives:

- To introduce about database management systems
- To give a good formal foundation on the relational model of data and usage of Relational Algebra
- To introduce the concepts of basic SQL as a universal Database language
- To demonstrate the principles behind systematic database design approaches by covering conceptualdesign, logical design through normalization
- To provide an overview of physical design of a database system, by discussing Database indexingtechniques and storage techniques

Course Outcomes:

At the end of the Course, the student will be able to

CO1 : Describe a relational database and object-oriented database
CO2 : Create, maintain and manipulate a relational database using SQL
CO3: Describe ER model and normalization for database design
CO4 : Examine issues in data storage and query processing and can formulate appropriate solutions
CO5: Outline the role and issues in management of data such as efficiency, privacy, security, ethicalresponsibility, and strategic advantage

UNIT I

Introduction: Database system, Characteristics (Database Vs File System), Database Users (Actors on Scene, Workers behind the scene), Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure.

UNIT II

Relational Model: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance **BASIC SQL**: Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update), basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL functions(Date and Time, Numeric, String conversion).

UNIT III

Entity Relationship Model: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams. **SQL**: Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, view(updatable and non-updatable), relational set operations.

UNIT IV

Schema Refinement (Normalization):Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency(1NF, 2NF and 3 NF), Boyce-codd normal form(BCNF), Lossless join and dependency preserving decomposition, Fourth normal form(4NF), Fifth Normal Form (5NF).

UNIT V

Transaction Concept: Introduction of Transaction Processing, DBMS Buffers, Concurrency control, Types of Failures, Transaction states and Operations, System log, Transaction Properties, Schedules and Types of Schedules.

Indexing Techniques: File Organization and Indexing, Cluster Indexes, Primary and Secondary Indexes, Index data Structures, Hash Based Indexing: Tree base Indexing, Comparison of File Organizations.

Text Books:

1) Database Management Systems, 3rd edition, Raghurama Krishnan, Johannes Gehrke, TMH (For Chapters 2, 3, 4)
2) Database System Concepts,5th edition, Silberschatz, Korth, Sudarsan,TMH (For Chapter 1 and Chapter 5)

Reference Books:

7) Introduction to Database Systems, 8/e C J Date, PEA.
8) Database Management System, 6/e RamezElmasri, Shamkant B. Navathe, PEA
9) Database Principles Fundamentals of Design Implementation and Management, Corlos Coronel,Steven Morris, Peter Robb, Cengage Learning.

e-Resources:

1) https://nptel.ac.in/courses/106/105/106105175/
2) https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0127580666728 2022456_shared/overview

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - IV

Course Code	Course Name	L	T	P	C
23CD4T03	OBJECT ORIENTED PROGRAMMING THROUGH JAVA	3	0	0	3

Course Objectives:

The learning objectives of this course are:

- To identify Java language components and how they work together in applications
- To learn the fundamentals of object-oriented programming in Java, including defining classes,invoking methods, using class libraries.
- To learn how to extend Java classes with inheritance and dynamic binding and how to use exceptionhandling in Java applications
- To understand how to design applications with threads in Java
- To understand how to use Java APIs for program development

Course Outcomes:

At the end of the Course, the student will be able to

CO1: Able to realize the concept of Object Oriented Programming & Java Programming Constructs

CO2: Able to describe the basic concepts of Java such as operators, classes, objects, inheritance, packages,Enumeration and various keywords.

CO3: Apply the concept of exception handling and Input/ Output operations

CO4: Able to design the applications of Java & Java applet

CO5: Able to Analyse & Design the concept of Event Handling and Abstract Window Toolkit

UNIT I

Program Structure in Java: Introduction, Writing Simple Java Programs, Elements or Tokens in Java Programs, Java Statements, Command Line Arguments, User Input to Programs, Escape Sequences Comments, Programming Style.

Data Types, Variables, and Operators :Introduction, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, Formatted Output with printf() Method, Static Variables and Methods, Attribute Final, Introduction to Operators, Precedence and Associativity of Operators, Assignment Operator (=), Basic Arithmetic Operators, Increment (++) and Decrement (- -) Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bitwise Logical Operators.

Control Statements: Introduction, if Expression, Nested if Expressions, if–else Expressions, Ternary Operator?:, Switch Statement, Iteration Statements, while Expression, do–while Loop, for Loop, Nested for Loop, For–Each for Loop, Break Statement, Continue Statement.

UNIT II

Classes and Objects: Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Access Control for Class Members, Accessing Private Members of Class, Constructor Methods for Class, Overloaded Constructor Methods, Nested Classes, Final Class and Methods, Passing Arguments by Value

and by Reference, Keyword this.

Methods: Introduction, Defining Methods, Overloaded Methods, Overloaded Constructor Methods, Class Objects as Parameters in Methods, Access Control, Recursive Methods, Nesting of Methods, Overriding Methods, Attributes Final and Static.

UNIT III

Arrays: Introduction, Declaration and Initialization of Arrays, Storage of Array in Computer Memory, Accessing Elements of Arrays, Operations on Array Elements, Assigning Array to Another Array, Dynamic Change of Array Size, Sorting of Arrays, Search for Values in Arrays, Class Arrays, Two-dimensional Arrays, Arrays of Varying Lengths, Three-dimensional Arrays, Arrays as Vectors.

Inheritance: Introduction, Process of Inheritance, Types of Inheritances, Universal Super Class-Object Class, Inhibiting Inheritance of Class Using Final, Access Control and Inheritance, Multilevel Inheritance, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance.

Interfaces: Introduction, Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces, Inheritance of Interfaces, Default Methods in Interfaces, Static Methods in Interface, Functional Interfaces, Annotations.

UNIT IV

Packages and Java Library: Introduction, Defining Package, Importing Packages and Classes into Programs, Path and Class Path, Access Control, Packages in Java SE, Java.lang Package and its Classes, Class Object, Enumeration, class Math, Wrapper Classes, Auto-boxing and Auto-unboxing, Java util Classes and Interfaces, Formatter Class, Random Class, Time Package, Class Instant (java. time. Instant), Formatting for Date/Time in Java, Temporal Adjusters Class, Temporal Adjusters Class.

Exception Handling :Introduction, Hierarchy of Standard Exception Classes, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throwable, Unchecked Exceptions, Checked Exceptions, try-with-resources, Catching Subclass Exception, Custom Exceptions, Nested try and catch Blocks, Rethrowing Exception, Throws Clause.

UNIT V

String Handling in Java: Introduction, Interface Char Sequence, Class String, Methods for Extracting Characters from Strings, Methods for Comparison of Strings, Methods for Modifying Strings, Methods for Searching Strings, Data Conversion and Miscellaneous Methods, Class String Buffer, Class String Builder.

Multithreaded Programming: Introduction, Need for Multiple Threads Multithreaded Programming for Multi-core Processor, Thread Class, Main Thread- Creation of New Threads, Thread States, Thread Priority-Synchronization, Deadlock and Race Situations, Inter-thread Communication - Suspending, Resuming, and Stopping of Threads.

Java Database Connectivity: Introduction, JDBC Architecture, Installing MySQL and MySQL Connector/J, JDBC Environment Setup, Establishing JDBC Database Connections, ResultSet Interface, Creating JDBC Application, JDBC Batch Processing, JDBC Transaction Management

Text Books:

1) JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.
2) The complete Reference Java, 8th edition, Herbert Schildt, TMH

References Books:

1) Introduction to java programming, 7th edition by Y Daniel Liang, Pearson
2) Murach's Java Programming, Joel Murach

E-Resources:

1) https://nptel.ac.in/courses/106/105/106105191/
2) https://www.w3schools.com/java/java_data_types.asp

DEPARTMENT OF CSE - DATA SCIENCE
SEMESTER - IV

Course Code	Course Name	L	T	P	C
23SH4M01	DESIGN THINKING & INNOVATION	2	0	0	0

Course Objectives: The objectives of the course are to

1. Bring awareness on innovative design and new product development.
2. Explain the basics of design thinking.
3. Familiarize the role of reverse engineering in product development.
4. Train how to identify the needs of society and convert into demand.
5. Introduce product planning and product development process.

UNIT I : Introduction to Design Thinking

Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

UNIT II : Design Thinking Process

Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brainstorming, product development.

Activity: Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

UNIT III : Innovation

Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations. Creativity to Innovation. Teams for innovation, Measuring the impact and value of creativity.

Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

UNIT IV : Product Design

Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications. Innovation towards product design Case studies.

Activity: Importance of modeling, how to set specifications, Explaining their own product design.

UNIT V : Design Thinking in Business Processes

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs. Design thinking for Startups. Defining and testing Business Models and Business Cases. Developing & testing prototypes.

Activity: How to market our own product, about maintenance, Reliability and plan for startup.

Text Books:

1. Tim Brown, Change by design, 1/e, Harper Bollins, 2009.
2. Idris Mootee, Design Thinking for Strategic Innovation, 1/e, Adams Media, 2014.

Reference Books:

1. David Lee, Design Thinking in the Classroom, Ulysses press, 2018.
2. Shrrutin N Shetty, Design the Future, 1/e, Norton Press, 2018.
3. William lidwell, Kritinaholden, &Jill butter, Universal principles of design, 2/e, Rockport Publishers, 2010.
4. Chesbrough.H, The era of open innovation, 2003.

E- REFERENCES:

1. https://nptel.ac.in/courses/110/106/110106124/
2. https://nptel.ac.in/courses/109/104/109104109/
3. https://swayam.gov.in/nd1_noc19_mg60/preview
4. https://onlinecourses.nptel.ac.in/noc22_de16/preview

DEPARTMENT OF CSE - DATA SCIENCE

SEMESTER - IV

Course Code	Course Name	L	T	P	C
23CD4L01	DATABASE MANAGEMENT SYSTEMS LAB	0	0	3	1.5

Course Objectives:

This Course will enable students to

- Populate and query a database using SQL DDL/DML Commands
- Declare and enforce integrity constraints on a database
- Writing Queries using advanced concepts of SQL
- Programming PL/SQL including procedures, functions, cursors and triggers

Course Outcomes:

At the end of the Course, the student will be able to

CO1 : Utilize SQL to execute queries for creating database and performing data manipulation Operations.

CO2 : Examine integrity constraints to build efficient databases

CO3 : Apply Queries using Advanced Concepts of SQL

CO4 : Build PL/SQL programs including stored procedures, functions, cursors and triggers

List of Exercises:

1. Creation, altering and droping of tables and inserting rows into a table (use constraints while creatingtables) examples using SELECT command.
2. Queries (along with sub Queries) using ANY, ALL, IN, EXISTS, NOTEXISTS, UNION, INTERSET, Constraints. Example: Select the roll number and name of the student who secured fourth rank in the class.
3. Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views.
4. Queries using Conversion functions (to_char, to_number and to_date), string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), date functions (Sysdate, next_day, add_months, last_day, months_between, least, greatest, trunc, round, to_char, to_date)
5.
    i. Create a simple PL/SQL program which includes declaration section, executable section and exception –Handling section (Ex. Student marks can be selected from the table and printedfor those who secured first class and an exception can be raised if no records were found)
    ii. Insert data into student table and use COMMIT, ROLLBACK and SAVEPOINT in PL/SQL block.
6. Develop a program that includes the features NESTED IF, CASE and CASE expression.The program can be extended using the NULLIF and COALESCE functions
7. Program development using WHILE LOOPS, numeric FOR LOOPS, nested loops using ERROR Handling, BUILT –IN Exceptions, USE defined Exceptions, RAISE- APPLICATION

ERROR.

8. Programs development using creation of procedures, passing parameters IN And OUT of PROCEDURES.
9. Program development using creation of stored functions, invoke functions in SQL Statements andwrite complex functions
10. Develop programs using features parameters in a CURSOR, FOR UPDATE CURSOR, WHERECURRENT of clause and CURSOR variables.
11. Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers and INSTEAD OF Triggers
12. Create a table and perform the search operation on table using indexing and non-indexingtechniques.

Text Books/Suggested Reading:

1) Oracle: The Complete Reference by Oracle Press
2) Nilesh Shah, "Database Systems Using Oracle", PHI, 2007
3) Rick F Vander Lans, "Introduction to SQL", Fourth Edition, Pearson Education, 2007

DEPARTMENT OF CSE - DATA SCIENCE

SEMESTER - IV

Course Code	Course Name	L	T	P	C
23CD4L02	OBJECT ORIENTED PROGRAMMING THROUGH JAVA LAB	0	0	3	1.5

Course Objectives:

The aim of this lab is to

- Practice programming in the Java
- Gain knowledge of object-oriented paradigm in the Java programming language
- Learn use of Java in a variety of technologies and on different platforms

Course Outcomes:

At the end of the Course, the student will be able to

CO1: Evaluate default value of all primitive data type, Operations, Expressions, Control-flow, Strings

CO2: Determine Class, Objects, Methods, Inheritance, Exception, Runtime Polymorphism, User defined Exception handling mechanism.

CO3: Illustrating simple inheritance, multi-level inheritance, Exception handling mechanism

CO4: Construct Threads, Event Handling, implement packages, developing applets

Exercise - 1 (Basics)

a) Write a JAVA program to display default value of all primitive data type of JAVA

b) Write a java program that display the roots of a quadratic equation $ax^2+bx=0$. Calculate the discriminate D and basing on value of D, describe the nature of root.

c) Five Bikers Compete in a race such that they drive at a constant speed which may or may not be the same as the other. To qualify the race, the speed of a racer must be more than the average speed of all 5 racers. Take as input the speed of each racer and print back the speed of qualifying racers

Exercise - 2 (Operations, Expressions, Control-flow, Strings)

a) Write a JAVA program to search for an element in a given list of elements using binary searchmechanism.

b) Write a JAVA program to sort for an element in a given list of elements using bubble sort

c) Write a JAVA program to sort for an element in a given list of elements using merge sort.

d) Write a JAVA program using String Buffer to delete, remove character

Exercise - 3 (Class, Objects)

a) Write a JAVA program to implement class mechanism. Create a class, methods and invoke them inside main method.

b) Write a JAVA program to implement constructor

Exercise - 4 (Methods)

a) Write a JAVA program to implement constructor overloading.

b) Write a JAVA program implement method overloading

Exercise - 5 (Inheritance)

a) Write a JAVA program to implement Single Inheritance
b) Write a JAVA program to implement multi level Inheritance
c) Write a java program for abstract class to find areas of different shapes

Exercise - 6 (Inheritance - Continued)

a) Write a JAVA program give example for "super" keyword.
b) Write a JAVA program to implement Interface. What kind of Inheritance can be achieved?

Exercise - 7 (Exception)

a) Write a JAVA program that describes exception handling mechanism
b) Write a JAVA program Illustrating Multiple catch clauses

Exercise – 8 (Runtime Polymorphism)

a) Write a JAVA program that implements Runtime polymorphism
b) Write a Case study on run time polymorphism, inheritance that implements in above problem

Exercise – 9 (User defined Exception)

a) Write a JAVA program for creation of Illustrating throw
b) Write a JAVA program for creation of Illustrating finally
c) Write a JAVA program for creation of Java Built-in Exceptions
d) Write a JAVA program for creation of User Defined Exception

Exercise – 10 (Threads)

a) Write a JAVA program that creates threads by extending Thread class .First thread display "Good Morning "every 1 sec, the second thread displays "Hello "every 2 seconds and the third display "Welcome" every 3 seconds ,(Repeat the same by implementing Runnable)
b) Write a program illustrating **isAlive** and **join ()**
c) Write a Program illustrating Daemon Threads.

Exercise - 11 (Threads continuity)

a) Write a JAVA program Producer Consumer Problem
b) Write a case study on thread Synchronization after solving the above producer consumer problem

Exercise – 12 (Packages)

a) Write a JAVA program illustrate class path
b) Write a case study on including in class path in your os environment of your package.
c) Write a JAVA program that import and use the defined your package in the previous Problem

Exercise - 13 (Applet)

a) Write a JAVA program to paint like paint brush in applet.
b) Write a JAVA program to display analog clock using Applet.
c) Write a JAVA program to create different shapes and fill colors using Applet.

Exercise - 14 (Event Handling)

a) Write a JAVA program that display the x and y position of the cursor movement using Mouse.
b) Write a JAVA program that identifies key-up key-down event user entering text in a Applet

TEXT BOOKS:

1. Herbert schildt and Dale skrien, Java Fundamentals- A Comprehensive introduction, TMH.
2. P.J.Dietel and H.M.Dietel, Java: How to Program , PHI.

REFERENCE BOOKS:

1. P.Radha Krishna, Object Oriented Programming through java, Universities Press.
2. Bruce Eckel, Thinking in Java, Pearson Education.
3. S.Malhotra and S.Choudhary, Programming in Java, Oxford University Press