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COURSE STRUCTURE (R23)
AND
DETAILED SYLLABUS
(II YEAR)

COMPUTER SCIENCE AND ENGINEERING
(Artificial Intelligence and Machine Learning)

For
B.Tech., Four Year Degree Course
(Applicable for the batches admitted from 2023-24)

LENDI INSTITUTE OF ENGINEERING AND TECHNOLOGY

An Autonomous Institution
Approved by AICTE & Permanently Affiliated to JNTUGV, Vizianagaram
Accredited by NAAC with "A" Grade and NBA (CSE,ECE, EEE & ME)
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COURSE STRUCTURE AND DETAILED SYLLABUS
B.TECH- COMPUTER SCIENCE AND ENGINEERING
(Artificial Intelligence & Machine Learning)

S.No	Course Code	Course Name	L	T	P	Credits
II Year I Semester						
1.	R23BSH-MA2101	Mathematical Foundations of Computer Science	3	0	0	3
2.	R23BSH-HM2101	Universal Human Values-Understanding Harmony and Ethical Human Conduct	2	1	0	3
3.	R23CSM-ES2101	Principles of Artificial Intelligence	3	0	0	3
4.	R23CSM-PC2101	Python Programming	3	0	0	3
5.	R23CSM-PC2102	Database Management Systems	3	0	0	3
6.	R23CSM-PC2103	Python Programming Lab	0	0	3	1.5
7.	R23CSM-PC2104	Database Management Systems Lab	0	0	3	1.5
8.	R23BSH-SC2101	English for Employability Skills (Skill Oriented Course)	0	1	2	2
9.	R23BSH-MC2101	Environmental Science (Mandatory Courses)	2	0	0	0
		Total	16	2	8	20

S.No	Course Code	Course Name	L	T	P	Credits
II Year II Semester						
1.	R23BSH-HM2201	Managerial Economics & Financial Analysis	2	0	0	2
2.	R23BSH-MA2201	Probability & Statistics	3	0	0	3
3.	R23CSM-PC2201	Machine Learning	3	0	0	3
4.	R23CSM-PC2202	Java Programming	3	0	0	3
5.	R23CSM-PC2203	Digital Logic & Computer Organization	3	0	0	3
6.	R23CSM-PC2204	Java Programming Lab	0	0	3	1.5
7.	R23CSM-PC2205	Machine Learning Lab	0	0	3	1.5
8.	R23CSM-SC2201	NoSQL Databases (Skill Oriented Course)	0	1	2	2
9.	R23CSM-ES2201	Design Thinking & Innovation	1	0	2	2
		Total	15	1	10	21

Honor Course-1

Community Service Project
(During the Summer Vacation after Second Year & Evaluated in III-I Semester)

Course code	Course Title	L	T	P	Credits
R23BSH-MA2101	Mathematical Foundations for Computer Science	3	0	0	3

Course Objectives:

- To develop a solid understanding of fundamental mathematical concepts essential for computer science and engineering.
- To provide students sufficient knowledge and skills enabling them to undertake further studies in engineering and its allied areas on multiple disciplines concerned with discrete mathematics.
- To foster critical thinking and logical reasoning skills to approach and solve engineering challenges methodically.
- To develop teamwork skills by engaging in collaborative projects and group problem-solving activities, simulating real-world engineering environments.
- To design algorithms, focusing on efficiency, complexity, and correctness with discrete mathematical concepts.
- To Develop and refine problem-solving skills by applying discrete mathematics to real-world problems and scenarios in computer science and engineering.

Course Outcomes:

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

1. Analyze formal proofs using logical arguments through logical and analytical reasoning.
2. Apply the core concepts of sets, relations, functions to computer science and engineering.
3. Apply graph theory, tree theory, and algorithms to solve problems in computer science.
4. Apply the concepts of elementary number theory to cryptography.
5. Apply suitable methods to solve computational problems involving recurrence relations.

UNIT-I

Propositional Calculus: Statements, negation, conjunction, disjunction, conditional and biconditional, well-formed formulae, tautologies, equivalence of formulae, duality, tautological implications, principal disjunctive and conjunctive normal forms, inference calculus, and rules of inference. Applications

Predicate Calculus: Predicative logic, free & bound variables, quantifiers, rules of inference. Applications

UNIT-II

Set Theory: Introduction, Operations on Binary Sets, Principle of Inclusion and Exclusion, Pigeon- hole principles and its applications.

Relations: Relation, Matrix representation of a relation and Digraph representation of a relation, Operations on Relations, Partition and Covering, Transitive Closure, Equivalence, Warshall's Algorithm, Partial Ordering Relations, Poset, Hassie Diagrams, Lattice and its Properties.

Functions: Bijective Functions, Composition of Functions, Inverse Functions, Permutations, Recursive Functions.

Algebraic Structures: Binary Relations, Monoid, semi-group, group and abelian group.

(Note: definitions, properties (without proofs) and problems only)

UNIT-III

Graph Theory: Basic Concepts of Graphs, Matrix Representation of Graphs: Adjacency Matrices, Incidence Matrices, Sub graphs, Isomorphic Graphs, cycle, Paths and Circuits, bipartite graph, Eulerian and Hamiltonian Graphs, Multigraphs, Planar Graphs, Euler's

Formula, Graph Colouring and Covering, Chromatic Number, Trees, Spanning Trees, Kruskal's and Prims Algorithms for Spanning Trees and its applications.
(Note: Problems Only and Theorems without Proofs)

UNIT-IV

Number Theory: Properties of integers, divisibility, Division theorem, Greatest Common Divisor (GCD), Euclidean algorithm, Least Common Multiple (LCM), testing for prime numbers, The Fundamental theorem of arithmetic, floor, ceiling functions.

Modular Arithmetic: Congruences, congruence equations, Fermat's theorem, Euler's totient function, Euler's theorem.

Cryptographic Applications: Plaintext, ciphertext, shift and affine ciphers, secret sharing.
(Note: All theorems without proofs)

UNIT-V

Recurrence relations: Recurrence relations, substitution method, solving homogeneous linear recurrence relations by characteristic roots method, non-homogeneous linear recurrence relations: Method of undetermined coefficients, Generating functions method.

Text Books

1. J.P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill, 2017. **(for Unit-I &II)**
2. Joe L. Mott, Abraham Kandel and T. P. Baker, Discrete Mathematics for computer scientists & Mathematicians, 2/e, Prentice Hall of India Ltd, 2017. **(for Unit-III &V)**
3. Ivan Niven, S. Zuckerman, An Introduction to Theory of Numbers, 5th edition, 2008, Wiley & Sons **(for Unit-IV).**
4. James S. Kraft, Lawrence C. Washington, An introduction to Number Theory and Cryptography, CRC Press, Taylor's and Francis group, 2nd edition, 2018 **(For Unit-IV).**

Reference Books

1. Keneth. H. Rosen, Discrete Mathematics and its Applications, 8/e, Tata McGraw-Hill, 2011.
2. Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science, Prentice Hall of India, 2006.
3. Susanna S. Epp, Discrete Mathematics with Application, Brooks/Colt Cengage learning, fourth edition.
4. Richard Johnsonburg, Discrete mathematics, 7/e, Pearson Education, 2008.
5. T. Koshy, Discrete Mathematics with Applications, Elsevier, New York, 2004.
6. J. A. Bondy, U. S. R. Murty, Graph Theory, Springer-Verlag, New York, 2008.
7. K. D. Joshi, Foundations of Discrete Mathematics, New Age International, 1989.
8. Prakash Om, Theory of Numbers, Golden Series, 2005.
9. George Tourlakis, Discrete Mathematics A Concise Introduction, Springer, 2024
10. Ali Grami, Discrete Mathematics. Essentials and Applications-Elsevier, Academic Press 2023.
11. Santosh Kumar Yadav, Discrete Mathematics with Graph Theory-Springer, 2023
12. Volker Diekert, Manfred Kufleitner, Gerhard Rosenberger, Ulrich Hertrampf , Elements of Discrete Mathematics: Numbers and Counting, Groups, Graphs, Orders and Lattices-De Gruyter (2024).

Course code	Course Title	L	T	P	Credits
R23BSH-HM2101	Universal Human Values: Understanding Harmony and Ethical Human Conduct	2	1	0	3

Course Objectives:
- Development of a holistic perspective based on value education and right understanding.
- Build harmony in the human being, Outline and strengthening of self-reflection.
- Develop Harmony in the family and society and interconnectedness with universal human order.
- Make use of mutual fulfilment relate to orders of nature and holistic perception of societal aspects.
- Integrate the humanistic constitution and humanistic universal order.

Course Outcomes:
1. Implement elements and process of value education.
2. Recognize thoughts, emotions and physical sensations of the self and the body and harmonizing their relationship.
3. Analyze human relations and their role in ensuring harmonious society.
4. Develop interconnected nature of existence encourages actions that contribute to global peace, justice and sustainability.
5. Make use of humanistic constitution, mutual respect and universal human order with holistic technologies.

UNIT-I
Introduction to Value Education: Understanding Value Education- Self-exploration as the Process for Value Education- Continuous Happiness and Prosperity – Basic Human Aspirations - Right Understanding, Relationship and Physical Facility - Happiness and Prosperity – Current Scenario.

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-The Body as an Instrument of the Self -Understanding Harmony in the Self - Harmony of the Self with the Body.

UNIT-III
Harmony in the Family and Society: Harmony in the Family – Basic Unit of Human Interaction - Values in Human-to-Human Relationship - 'Trust' – Foundational Value in Relationship - 'Respect' – Right Evaluation -Understanding Harmony in the Society -Vision for the Universal Human Order.

UNIT-IV
Harmony in the Nature/Existence: Understanding Harmony in the Nature - Interconnectedness, self-regulation and Mutual Fulfilment among theFour 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 andUniversal Human Order - Competence in Professional Ethics - Holistic Technologies, Production Systems and Management Models.

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

87034- 47-1

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 My Experiments with Truth - by Mohandas Karamchand Gandhi, Publisher : Prabhat Prakashan; 1st edition (1 January 2018); Prabhat Prakashan Pvt. Ltd, New Delhi-110002
4. Small is Beautiful - E. F Schumacher. Blond & Briggs (1973–2010), HarperCollins (2010)
5. Slow is Beautiful - Cecile Andrews, New Society Publishers (1 October 2006)
6. Economy of Permanence - J C Kumarappa, Publisher : Sarva Seva Sangh Prakashan (1 January 2017)
7. India Wins Freedom - Maulana Abdul Kalam Azad, Publisher : Orient BlackSwan; 1st Edition (1 January 1988)
8. Vivekananda - Romain Rolland (English), Publisher : Advaita Ashrama, India; Fourth Impression edition (30 March 2010)

Course Code	Course Name	L	T	P	Credits
R23CSM-ES2101	Principles of Artificial Intelligence	3	0	0	3

Course Objectives:
- The student should be made to study the concepts of Artificial Intelligence.
- The student should be made to learn the methods of solving problems using AI.
- To understand the applications of AI, namely game playing, theorem proving, and machine learning.
- To learn different knowledge representation techniques
- The student should be made to introduce the concepts of Expert Systems.

Course Outcomes:
After completion of the course, students will be able to
1. Understand the concepts of artificial intelligence.
2. Apply problem-solving strategies and perform search operations using heuristic techniques.
3. Summarize different knowledge representation techniques.
4. Apply the concepts of backward chaining using logic concepts.
5. Understand the architecture and role of expert system in AI.

UNIT - I

Introduction: AI problems, foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation.

UNIT - II

Searching- Searching for solutions, uniformed search strategies – Breadth first search, depth first Search. Search with partial information (Heuristic search) Hill climbing, A*, AO* Algorithms, Problem reduction, Game Playing-Adverbial search, Games, mini-max algorithm, optimal decisions in multiplayer games, Problem in Game playing, Alpha-Beta pruning, Evaluation functions.

UNIT - III

Representation of Knowledge: Knowledge representation issues, predicate logic- logic programming, semantic nets- frames and inheritance, constraint propagation, representing knowledge using rules, rule-based deduction systems. Reasoning under uncertainty, review of probability, Bayes' probabilistic interferences and dempster Shafer theory.

UNIT - IV

Logic concepts: First order logic. Inference in first order logic, propositional vs. first order inference, unification & lifts forward chaining, Backward chaining, Resolution, Learning from observation Inductive learning, Decision trees, Explanation based learning, Statistical Learning methods, Reinforcement Learning.

UNIT - V

Expert Systems: Architecture of expert systems, Roles of expert systems – Knowledge Acquisition Meta knowledge Heuristics. Typical expert systems – MYCIN, DART, XCON: Expert systems shells.

Text Books
1. S. Russel and P. Norvig, "Artificial Intelligence – A Modern Approach", Second Edition, Pearson Education.
2. Kevin Night and Elaine Rich, Nair B., "Artificial Intelligence (SIE)", Mc Graw Hill

Reference Books

1. David Poole, Alan Mackworth, Randy Goebel, "Computational Intelligence: a logical approach", Oxford University Press.
2. G. Luger, "Artificial Intelligence: Structures and Strategies for complex problem solving", Fourth Edition, Pearson Education.
3. J. Nilsson, "Artificial Intelligence: A new Synthesis", Elsevier Publishers.
4. Artificial Intelligence, Saroj Kaushik, CENGAGE Learning.

Web Resources

1. https://ai.google/
2. https://swayam.gov.in/nd1_noc19_me71/preview

Course Code	Course Name	L	T	P	Credits
R23CSM-PC2101	Python Programming	3	0	0	3

Course Objectives:
- Understand the structure and data types of Python script.
- Implement iterations and functions in Python.
- Implement modules and understand packages.
- Implement data structures using mutable & immutable objects.
- Understand object-oriented concepts and Exception handling.

Course Outcomes:
1. Implement Basic Python Programming Fundamentals for Computation of Expression.
2. Apply Iterators and functions in data processing.
3. Understand modules and packages to leverage powerful libraries for data science tasks.
4. Implement sequences and data structures for data organization.
5. Implement object-oriented principles in Python, handling run-time errors.

UNIT-I

Introduction: History of Python, Features of Python, Applications, Python Using the REPL (Shell), Running Python Scripts, Variables, Assignment forms, Keywords, Input-Output, Indentation.

Operators and Type Conversion: Data Types: Numeric, Booleans, Sequence, Strings, Type Conversions, Operators, Operator Precedence, Evaluation of Expressions.

UNIT-II

Control Flow: Conditional statements (if, else, elif), Looping structures (for, while, for-else, while-else) Transfer Control Statements**:** break, continue, pass.

Functions: Defining Functions, Calling Functions, Types of Arguments: Keyword Arguments, Default Arguments, Variable-length arguments, Fruitful Functions (Function Returning Values), Scope of the Variables in a Function - Global and Local Variables, Anonymous Functions, Lambda, map, reduce and filter.

UNIT-III

Modules: Creating modules, import statement, from import statement, namespace, built-in modules- OS, random, Math, JSON, request, date, RegEx, itertools.

Packages: Introduction to PIP**,** Installing packages using PIP.

Exploring Data Science Libraries: NumPy, Pandas, Data visualization: Matplotlib

UNIT-IV

Strings & Data Structures: String**,** String Formatting**,** List, String and List Slicing, Tuple, Sets, Frozen Sets, Dictionaries, Comprehensions, Built-in methods of all sequences, File Handling: Reading and writing files, File modes and file objects

UNIT-V

Object Oriented Programming OOP in Python: Classes, 'self- variable', Methods, Constructor, Inheritance, Polymorphism, and Data Abstraction.

Errors and Exceptions: Syntax Errors, Exceptions, Exception Handlers, Raising Exceptions, User-defined Exceptions.

Text Books
1. Let Us Python by Yashavant Kanetkar ,Aditya Kanetkar ,6th edition, BPB Publication-2024
2. Python Programming: Using Problem Solving Approach by Reema Theraja,2nd edition, Oxford publications-2024

Reference Books

1. Core python programming by Dr R Nageswarao ,Dreamtech press,3rd edition,2021
2. Learning Python, Mark Lutz, Orielly,5th edition-2017
3. Python Programming, S Sridhar, J Indumathi, V M Hariharan, 2nd Edition, Pearson, 2024

Course Code	Course Name	L	T	P	Credits
R23CSM-PC2102	Database Management Systems	3	0	0	3

Course objectives:

- Describe the fundamental elements of relational database management systems
- Design ER models to represent simple database application scenarios
- Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra, and SQL.
- Improve the database design by normalization.
- Familiar with the basic issues of transaction processing, concurrency control, and crash recovery
- Familiarity with basic database storage structures and access techniques, including file and page organizations, indexing methods including B tree, and hashing.
- Knowledge about the advanced databases.

Course Outcomes:

1. Design the ER model using the basic concepts of DBMS.
2. Apply SQL concepts to Construct simple and complex queries.
3. Analyze schema refinement techniques.
4. Understand transaction serializability and concurrency control.
5. Apply the B & B+ Trees concepts on database storage.

UNIT-I

Introduction- Database – Purpose, Characteristics, advantages, disadvantages and Applications, Database vs. File System, Database Users, Data Models: Concepts of Schema, Instance and data independence; Three Tier Schema Architecture, Database System Structure, Centralized and Client-Server architecture for the database.

ER Diagrams: Introduction, Entities, Attributes Entity Set, Relationship Set, Specialization, Generalization, Aggregation, Types of Keys.

UNIT-II

Relational Operations & Basic SQL: Relational Algebra, Relational Operations, Relational Calculus-Tuple And Domain Relational Calculus.

BASIC SQL: Database Languages (DDL, DML, DCL, TCL), data types, Operations, Simple, complex, nested, and sub-queries, SQL functions, Integrity Constraints- Primary key, foreign key, unique, not null, check, IN operator, grouping, aggregation, ordering, views, Implementation Of Different Types Of Joins - inner, left join, right join, natural join. Overview of Stored Procedures, Triggers.

UNIT-III

Schema Refinement (Normalization): Types Of Anomalies, Concept Of Functional Dependency, Normalization, Advantages, Types Of Normal Forms (1NF, 2NF, And 3NF).
Higher Normal Forms - Introduction, Boyce-Codd Normal Form (BCNF), Fourth Normal Form(4NF), Multi-valued dependencies, Lossless join and dependency preserving decomposition, and Fifth Normal form.

UNIT-IV

Transaction Management: Transaction, Transaction States, ACID Properties, Concurrent Executions Schedule, Serializability And Types, Concurrent Control, Concurrency Control Protocols-Two Phase Locking, Timestamp, Multi-version, Validation, Graph-Based, Hybrid Protocols, and Snapshot isolation– Multiple Granularity locking, Deadlocks,
Crash Recovery: Introduction To ARIES, The Log, Write-Ahead Log Protocol.

UNIT-V

File Organization and Indexing - RAID, File Organization, Indexing - B & B+ Tree Index files, Hashing Vs Indexing.
Introduction to Advanced Databases - NoSQL, NewSQL, Not-yet-SQL, and SQLite

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Text Books

1. Database Management Systems, 3/e, Raghuram Krishnan, Johannes Gehrke, TMH, 2003.
2. Database System Concepts, 7/e, Silberschatz, Korth, TMH, 2021.
3. Introduction to Database Systems,8/e C J Date, PEA 2006.

Reference Books

1. Database Management System, 6/e Ramez Elmasri, Shamkant B. Navathe, PEA, 2019.
2. Designing Data-Intensive Applications, by Martin Kleppmann, 2017,O'Reilly Media, Inc.
3. Advanced Database Systems" by Carlo Zaniolo, Stefano Ceri, Christos Faloutsos, Richard T. Snodgrass, V. S. Subrahmanian, and Roberto Zicari, Morgan Kaufman Publishers, 1997

Course Code	Course Name	L	T	P	Credits
R23CSM-PC2103	Python Programming-Lab	0	0	3	1.5

Course Objectives:
- Implement and debug simple Python programs.
- implement Python programs with Conditionals and Loops
- Learn Syntax and Semantics and create Functions in Python
- Implement compound data using Python Lists, Tuples, and Dictionaries.
- Implement Object Oriented Programming concepts in Python

Course Outcomes:

At the end of the course, students will be able to:
1. Understand the working environment of Python and its program structure.
2. Examine Python syntax and semantics and be fluent in the use of Python flow control and functions.
3. Implement Conditionals and Loops for Python Programs.
4. Use Python Lists, Tuples and Dictionaries for representing compound data.
5. Interpret the concepts of Object-Oriented Programming as used in Python

Experiment 1: Programs on Basic I/O

Sample Programs
a. Demonstrate the python script by running in Interactive and Script Mode.
b. Write a python script to read using input() and display using print() functions.
c. Write a Python Program to Convert Celsius To Fahrenheit
d. Write a Python program to compute area of triangle.
e. Write a program to calculate the circumference of the circle
f. Write a Python program to compute distance between two points in a 2-dimensional Coordinate system.
g. Write a program to swap two numbers without using a temporary variable.
h. Write a Python program that calculates number of seconds in a day
i. Write a python script to make use of all conversion functions.
j. Demonstrate the following Operators in Python with suitable examples. i) Arithmetic Operators ii) Relational Operators iii) Assignment Operators iv) Logical Operators v) Bit wise Operators vi) Membership Operators vii) Identity Operator.

Experiment 2: Programs on Decision Making

Sample Programs
a. Write a program to find the largest element among three Numbers.
b. Program to check whether a person is eligible to vote or not
c. Write the python script to print whether the roots are equal, distinct or complex for given coefficients a, b and c for quadratic equation
d. Write a Program to display all prime numbers within an interval
e. Write a Python program to find the given year is leap year or not
f. Write a program to find the factorial of a given number
g. write a python program to check whether given letter is vowels or not
h. Write a python script to take five subject marks and print the grade for the student.
i. writr a python script to read the person age from user and display Person status (1.age>60 senior citizen,2.age b/w 25 to 59 –working citizen,3.age b/w 16 to 24 college students ,4.age b/w 4 to 15 school kid,5.age b/w 1 to 3 play kid ,6.otherwise – invalied)
j. Write a program to print the reverse of number.

Experiment 3:Programs on Loops(for ,while)
Sample Programs

   a. Write a program to calculate GCD of two numbers
   b. Write a Python program to print the multiplication table of a given number using a for loop. Take the number as input from the user.
   c. Write a Python program to print the first N Fibonacci numbers using a while loop. Take N as input from the user.
   d. write a program using for loop to calculate factorial of a number
   e. Write a Python program using while loop to print first N numbers divisible by 5
   f. Program to add natural numbers up to sum = 1+2+3+...+n
   g. Write a program to take input as integer N and check whether N is Pronic Number or not. (Product of two consecutive numbers is pronic N(N+1): Eg 110 = 10*11)
   h. Write a python script to take input as amount in rupees R and find out the least number of notes N that can be possible to store in a Wallet.(Hint Notes: 2000,500,200,100,50,20,10) Eg: R=2589, N=5
   i. Write a program to check whether given number N is N-Series(Disarium) number or not. (Eg. 135 is N-Series Number because $1^1+3^2+5^3$ = 135 and some others are 89, 175, 518 etc)

Experiment 4: Programs Nested Loops(for ,while)
Sample Programs

   a. Write a Python program to add two 3x3 matrices using nested loops. The matrices should be predefined
   b. Write a python script to print the following pattern

```
1
1 2
1 2 3
1 2 3 4
1 2 3 4 5
```

   c. Write a python script to print the following pattern

```
1
2 2
3 3  3
4 4  4 4
5 5 5  5  5
```

   d. Write a python script to take input as String S="LENDI", print the following:

```
   L
  LEL
 LENEL
LENDNEL
LENDIDNEL
```

   e. Write a python script to print the any alphabet shape using *s.

```
 * * *
*     *
* *  * *
*     *
*     *
```

Experiment 5:Programs on Modules& Functions
Sample Programs
   a. Write a program to define a function with multiple return values
   b. Write a python script to implement different arguments in a function.
   c. Write a program to define a function using default arguments
   d. Write a python program to write the content "hi python programming" for the existing file?
   e. Create a calculator module containing add, sub, mul and div and access them
   f. Using Recursion, Write a program to take input as vehicle Number N and check whether N is Fancy number or not. (Folding of digits of number should be 9)
   g. Create a module named "Lendi" and create functions addStudent, removeStudent, searchStudent. Access the above module using import statement.
   h. Write a python script using lambdas, to take input as String, and sort the string SS in descending/ascending order according to their frequency of its occurrences of characters.(Eg. S='missisippi', SS=ispm)
   i. Python program to check whether a JSON string contains complex object or not

Experiment 6: ProgramsPermutations & Combinations
Sample Programs
   a. Write a python script to take input as number N, and find out the largest number L , that can be formed with N.Eg. N=679, P={679,697,769,796,967,976}, L = 976
   b. Write a python script to take input as list, L and print output as largest number L and total combinations C for given N digit number formed by the combination of L.(Eg. L=[1,2,1,4], N=3, L=421,C=12).
   c. Write a python script to print Prime pairs within a given range of numbers. (Hint N=20, then (3,5) (5,7) (11,13) (17,19) are prime pairs)
   d. By considering the terms in the Fibonacci sequence whose values do not exceed four million, find the sum of the even-valued terms.

Experiment 7:Programs String &Regular Expressions
Sample Programs
   a. Write a program to perform the given operations on a strings
   b. i) Creating the string   ii) slicing the string   iii) Delete character in the string
   c. Write a python script to take two string S1 and S2 and Check S1 and S2 are anagrams or not:
   d. Write a python script to take two string S1 and S2 and Check S1 is Sub string of S2 or not
   e. Write a python script to take two string S1 and S2 and check S1 is palindrome or not
   f. Write a Python program to reverse a given string using a for loop. Take the string as input from the user.
   g. Write a python script to take input as multi-line string and find the sum of all numbers in that string using re module. (Eg. S="he11o they are 40students in97 room of 4th line", Sum= 152)
   h. Using RegEx object check whether given phone number, email address and password is valid or not.
   i. Using date module, write a python script to take input as Date of birth (DOB) and current date(CD) and print age of the person.

Experiment 8: Programs Lists & Dictionary
Sample Programs
  a. Write a program to perform the given operations on a list:
     i) Creating the list   ii) slicing in the lists   iii) Adding Elements in List
     iv) Deleting the list elements
  b. Write a program to count the number of vowels in a string(No control flow allowed).
  c. Writeaprogram to check if a given key exists in a dictionary or not.
  d. Write a program to add a new key-value pair to an existing dictionary.
  e. Write a program to take input as String S and print frequency of each character in S using List data structure.
  f. Write a program to take input as String S contains characters and special symbols, reverse the String S such that special symbols remains at same position. (Eg. S="m@d#u" , Output="u@d#m").
  g. Write a python script to take input as String sentence S and print each word count using dictionary.
  h. Write a python script to implement Anonymous function.
  i. Write a python script to implement map(), reduce() and filter() functions

Experiment 9:Programs OOPS.
Sample Programs
  a. Write a Python program to create a person class. Include attributes like name, country and date of birth. Implement a method to determine the person's age.
  b. Write a Python program to create a calculator class. Include methods for basic arithmetic operations.
  c. Write a Python program to create a class representing a shopping cart. Include methods for adding and removing items, and calculating the total price.
  d. Using Python OOPS, create a class, constructor, method, __str__ and __repr__ for
  e. Employee
  f. Using Python OOPS, create a class, constructor, method, __str__ and __repr__ for
  g. Student

Experiment 10:Programs on Exceptions.
Sample Programs
  a. Write a python program to implement Exceptions hierarchy.
  b. Write a program to Catching Specific Exceptions in Python
  c. Python program to try with else clause.
  d. Write a Python program to handle a ZeroDivisionError exception when dividing a number by zero.
  e. Create a user defined Exception named "FundsLessException" and raise the exception when there are no enough funds in the bank account.

Experiment 11:Programs Data Analysis
Sample Programs
  a. Python Program to demonstrate NumPy arrays creation using array()function.
  b. Python script to load data sets.
  c. Write a python script to create a data frame.
  d. Python program to demonstrate use of ndim, shape,size,dtype.
  e. Using NumPy, implement different matrix operations in python.
  f. Using pandas, read the data from anytext files.

g. Python program to find min, max, sum, cumulative sum of array

h. Create a dictionary with at least five keys and each key represent value as a list where this list contains at least ten values and convert this dictionary as a pandas data frame and explore the data through the data frame as follows:Apply head() function to the pandas data frame

i. Perform various data selection operations on Data Frame

Experiment 12:Programs Plotting
Sample Programs

a. Create a line plot for a list of values over a period of time. Label the x-axis as "Time" and the y-axis as "Value".

b. Create a bar chart that shows the frequency of categories in a dataset. Use different colors for each bar.

c. Create a histogram to visualize the distribution of a numerical dataset. Customize the number of bins and add a title.

d. Create a scatter plot to show the relationship between two numerical variables. Add a trend line to the scatter plot.

e. Create a pie chart to show the proportion of different categories in a dataset. Add labels and percentages to each slice.

APPLICATIONS:

- Web Application Development and Scraping
- Designing Games
- Machine Learning and AI based applications
- Embedded Systems and IoT Applications
- Data Science and Visualization
- Embedded and CAD Applications

Text Books

1. The Complete reference -Python by Martin C. Brown,Indian Edition,Mc Graw hill Education(India)-2023,

2. Python programming by Dr Pooja Sharma,1st Edition, BPB Publication-2023

Course Code	Course Name	L	T	P	Credits
R23CSM-PC2104	Database Management Systems Lab	0	0	3	1.5

Course Objectives:
- 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:
1. Design the ER model using the basic concepts of DBMS, and RDBMS.
2. Apply SQL commands such as DDL, DML, DCL, and TCL to access data from database objects.
3. Applying String, Date, and Conversion Functions in DBMS.
4. Understand the procedure for writing Nested queries.
5. Develop PL/SQL stored procedures, stored functions, cursors, and Triggers.

List of Experiments:

SQL

Experiment 1: Conceptual Designing using ER Diagrams (Identifying entities, attributes, keys, and relationships between entities, cardinalities, generalization, specialization, etc.)
[Note: Student must submit a document by drawing an ER Diagram for the lab teacher.]
Experiment 2: Converting ER Model to Relational Model (Represent entities and relationships in Tabular form, Represent attributes as columns, identifying keys)
[Note: Student must submit a document showing the database tables created from the ER Model.]
Experiment 4: Creation of Tables using SQL- Overview of using SQL tool, Data types in SQL, User creation with DCL commands, Creating Tables (along with NOT NULL, CHECK, UNIQUE, Primary and Foreign key constraints), Altering Tables, Dropping Tables.
Experiment 5a: Create a sequence on a table for generating IDs
Experiment 5b: Practicing DML commands(Insert, Select, Update, Delete), and TCL commands (commit, Savepoint, Rollback)
Experiment 6: Practicing Queries using ANY, ALL, IN, EXISTS, NOT EXISTS, UNION, INTERSECT, etc.
Experiment 7. Practice Queries using COUNT, SUM, AVG, MAX, MIN, GROUP BY, ORDER BY, HAVING.
Experiment 8a: Practicing String functions, conversion functions, and date functions
Experiment 8b: Practicing Sub queries (Nested, Correlated) and Joins (Inner, Outer, and Equi).
[Note: All the queries need to be developed for the library management system or university management system, banking system, etc.]

PL/SQL

1) Create a PL/SQL block for implementing declare, begin, and exception blocks.
2) Create a PL/SQL block for implementing decision and looping statements.
3) Create a user-defined exception and raise, raise_application_error.
4) Create a procedure with In and Out parameters.
5) Create a function and call the function using the stored procedure.
6) Develop programs using feature parameters in a CURSOR, FOR UPDATE CURSOR,
    WHERE CURRENT of clause and CURSOR variables.
7) Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers.

Text Books

1. Oracle Database 12c: The Complete Reference by Oracle Press, 12C, Bob Byrla, Kevin Loney, 2013
2. Nilesh Shah, "Database Systems Using Oracle, PHI,2007.
3. Rick F Vander Lans, Introduction to SQL, Fourth Edition, Pearson Education,2007.
4. Ramez Elmasri, Shamkant, B. Navathe, "Database Systems", Pearson Education, 6th
5. Edition, 2013.

Web Resources:

1. http://www.scoopworld.in
2. http://vlabs.iitb.ac.in/vlabs-dev/labs/dblab/index.php

Course Code	Course Name	L	P	T	Credits
R23BSH-SC2101	English for Employability Skills (Skill Oriented Course)	0	1	2	2

Course Objectives
- Aims to help learners develop their English language skills, particularly those planning to appear for Competitive Exams that test their English Language abilities.
- Gains the power of expression through rich Vocabulary.
- Imparts critical reading strategies for comprehension of complex texts.
- Provides training and opportunities to develop fluency in English through participation in formal group discussions and Self Introductions.
- Demonstrates good writing skills for effective Paragraph Writing, Essay Writing and formal correspondence through emails.
- Encourages the use of a wide range of grammatical structures, Phrases, Clauses and Idioms in speech and writing.

Course Outcomes
1. Enable students to identify Parts of Speech and use them flawlessly, write Emails in formal correspondence effectively, participate confidently by introducing oneself in any formal discussion.
2. Attain Language Proficiency & Accuracy through Contextualized Vocabulary, Verb forms, Tense and subject-verb agreement, produce coherent expressions for professional writing, and introduce themselves unhesitatingly with Task-Based Activities.
3. Develop the fluency and accuracy to write Technical Reports and Emails for professional communication by using appropriate vocabulary and participating confidently in formal discussions.
4. Assimilate lifelong reading habits to comprehend a passage for its gist. Avoid errors in both Speech & Writing and write Letters and Emails for official communication. Realise the technical communicative competence and attainment of grammatically correct structures for formal communication.

<div align="center">Unit I</div>

Vocabulary: How to talk about actions. **Grammar:** Using and Identifying Parts of Speech accurately**. Writing:** Paragraph Writing and formal correspondence through Emails**. Speaking:** Background to Group discussions & Self-introductions.

<div align="center">Unit II</div>

Vocabulary: How to talk about various speech habits. **Grammar**: Learning Verb forms, Tenses and Subject-verb agreement and using them accurately in both Speaking and Writing contexts. **Writing :** Essay Writing and formal correspondence through Emails. **Speaking:** Four major areas -Subject Knowledge, Oral Communication Skills, Leadership Skills and Team Management-of GD;Real time GDs for Evaluation.

<div align="center">Unit III</div>

Vocabulary: How to insult your enemies**. Grammar:** Sentence Analysis & Synthesis - Voice, Degrees of Comparison, Reported Speech and Types & Forms of sentences. **Writing:** Report writing and Emails for formal correspondence**. Speaking:** Roles in structured GDs; real-time GDs for practising the above roles.

<div align="center">Unit IV</div>

Vocabulary: How to flatter your friends**. Grammar**: Common errors and Correction of

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Sentences **Reading:** Reading Comprehension passages through Skimming and Scanning and understanding the gist or the specific purpose of them. **Writing:** Letter writing and Emails. **Speaking:** Advantages of GDs for hiring process; real time GDs for evaluating.

Unit V

Vocabulary & Grammar: High-frequency words for all competitive exams, Clause, Phrase & Idioms**. Reading:** Reading for Comprehending **Writing:** Business Letters and Emails **Speaking:** Group Discussions for Evaluation

Reference Books

1. Bailey, Stephen. *Academic writing: A handbook for international students*. Routledge, 2014.
2. Chase, Becky Tarver. *Pathways: Listening, Speaking and Critical Thinking.* Heinley ELT; 2nd Edition, 2018.
3. Skilful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
4. Hewings, Martin. *Cambridge Academic English (B2)*. CUP, 2012. (Student Book, Teacher Resource Book, CD & DVD)
5. Word Power Made Easy by Norman Lewis

ASSESSMENT

The learners will demonstrate their knowledge and abilities through completion of the following required assessments while or at the end of this course. —2 Quizzes, 1 Professional Certificate, 3 Activities on LSRW skills.

Quiz: Quiz is conducted on Grammar & Vocabulary. Each Quiz consists of 50 questions and will be scaled down to 5 Marks. Two quizzes are conducted. One after the 3rd unit, the other, after the last unit. The duration of any quiz is 1hr 30 Min only. These Quizzes are Computer Based Tests (CBT)

Professional Certificate: An International Language Assessment Certificate secured on B1 of the Common European Framework for Reference (CEFR) scale.

Activities on LSRW skills:

Interviews: The candidate has to interview one celebrity of his/her own choice.

The recorded 5-7 min video of the candidate should be uploaded on the ELCS LABLendi Youtube Channel with the help of the concerned English Teacher

The Evaluation Parameters:
- Quality of the Questionnaire(3M)
- Body Language & Confidence of the candidate(5M)
- Youtube likes & Comments(2M)

E-mails:

Each student is required to submit 5 independently written Emails during the course. Specific requirements for each one are accessed on the following Link:

https://docs.google.com/document/d/1IXuzjjmfiOLI23t8xlbLwNefRzIIXi9aOi3XkSHIK_Q/edit?usp=sharing

Listen to Speak:

Students are expected to watch and listen to any one of the 10 given educational video and audio clips to express their point of view. After watching, they will have the opportunity to share their points of view about some of the everyday issues that they can relate to. They have to explain and justify their reasoning to a team of three peers to explore their verbal expressions and their points of view before an External Examiner.

The following is the link to access those clippings:

https://docs.google.com/document/d/1tFuQ_43AVAHKJGVs9AeOODHJTnQMoydqcodSgENaZ3o/edit?usp=drivesdk

Details of Peer Evaluation & Assessment Parameters are available on the following Link:
https://docs.google.com/document/d/16l_PUzaOONnjpvMYVzE3XAYUBNhqMK9PbdDOP
GIef_8/edit?usp=sharing

Grading:

Assessment Model	Points
Quiz-1	**20**
Quiz-2	**20**
Professional Certificate with B1 or above or Activity of Interview	**20**
E-Mails	**20**
Listen to the Speak Activity	**20**
Total	**100**

Pass Criterion:
1. The student has to Secure 40 Marks to pass this examination
2. A student with a certificate of any International standard of English has to secure a Minimum of 30 Marks in this examination (Certificate+30 Marks) to pass the summative exam.
3. A student who does not have an English Proficiency Certificate has to clear the exam with 40 marks mandatorily.
4. Clearing all categories is mandatory. One needs to get 60% of each category.

Course Code	Course Name	L	T	P	Credits
R23BSH-MC2101	Environmental Science (Mandatory Course)	2	0	0	0

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

Course Outcomes:
1. Understand the significance of various natural resources, including renewable, non renewable water, minerals, forests and soil, in the environment and the problems associated with it in maintaining ecological balance and supporting human activities.
2. Apply strategies for mitigating different types of environmental pollution, managing solid waste effectively and adopt individual actions that contribute to pollution prevention and waste reduction.
3. Understand the structure, function, characteristic features of different kind of eco systems, value of biodiversity, threats to bio diversity and India's role and strategies in the conservation of biodiversity for sustainable development.
4. Apply the Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife Protection Act, and Forest Conservation Act to promote sustainable environmental development; Address related social issues and propose effective solutions, delving into the intersection of environmental policies and community welfare to achieve ultimate sustainability goals.
5. Identify the role of information technology in addressing population-related problems, focusing on resource management, environmental monitoring, urban planning, healthcare improvement, education to enhance sustainability and quality of life.

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, case studies. – Energy resources:

UNIT II
Environmental Pollution: Definition, Cause, effects and control measures of:
a.   Air Pollution.
b.   Water pollution
c.   Soil pollution
d.   Marine pollution
e.   Noise pollution
f.   Thermal pollution

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, earthquake, cyclone, landslides and e-waste management.

UNIT III

Ecosystems: Concept of an 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:

a.   Forest ecosystem.
b.   Grassland ecosystem
c.   Desert ecosystem.
d.   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-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

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 and ozone layer depletion. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – 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, hill slopes, etc.

Textbooks:

1. Textbook of Environmental Studies for Undergraduate Courses Erach Bharucha forUniversity 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 Coursesas per UGC model syllabus", Scitech Publications (India), Pvt. Ltd.

References:

1. Deeksha Dave and E.Sai Baba Reddy, "Textbook of Environmental Science", CengagePublications
2. M. Anji Reddy, "Text book of Environmental Sciences and Technology", B S Publication.
3. J. P. Sharma, Comprehensive Environmental studies, Laxmi publications.
4. J. Glynn Henry and Gary W. 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 Wendell P. Ela, "Introduction to Environmental Engineering andScience, Prentice Hall of India Private limited.

Course Code	Course Name	L	T	P	Credits
R23BSH-HM2201	Managerial Economics & Financial Analysis	2	0	0	2

Course Objectives:
- Inculcate the basic knowledge with the concepts of Business, Economics and Finance.
- Analyze various factors of production with proposed theories in relation to cost - volume profit analysis.
- Identify micro environment in which markets operate, how price determination is done under different kinds of competitions and know the different forms of Business organization.
- Asess the best investment decisions by means of time value of money.
- Provide fundamental skills about accounting and explain the process of preparing accounting statements and analysis of financial statements.

Course Outcomes:
1. Equipped with the knowledge of fundamentals of economics, estimating the Demandfor a product, Capable of analyzing Elasticity & Forecasting methods.
2. Apply production concepts, assess the costs and Determine Break Even Point (BEP)of an enterprise for managerial decision making.
3. Identify the influence and price determination of various markets structures and knowledge of the forms of business organization and Business cycles.
4. Analyze how to invest adequate amount of capital in order to get maximum returnfrom selected business activity.
5. Analyze and interpret the process & principles of accounting & apply financial statements for appropriate decisions to run the business profitably.

Unit-I

Introduction to Managerial Economics and demand Analysis: Introduction to Managerial Economics: Definition, Nature and Scope of Managerial Economics– Demand Analysis: Demand Determinants, Law of Demand and its exceptions- Elasticity of Demand:Definition, Types, Measurement and Significance of Elasticity of Demand. Demand Forecasting, Factors governing demand forecasting, methods of demand forecasting- Law of Supply.
Application: Analyze the demand of a product by applying methods of the elasticity of demand.

Unit – II

Theories of Production and Cost Analysis: Production Function – Isoquants and Isocosts, Laws of Returns, Laws of return to Scale, Internal and External Economies of Scale. Cost Analysis: Cost concepts, Opportunity cost, Fixed vs. Variable costs, Explicit costs Vs. Implicit costs, Out of pocket costs vs. Imputed costs, Sunk costs, Historical cost. CVP analysis-Break-even Analysis (BEA) Significance and limitations -Determination of Break Even Point (simple Problems).
Application: Compute contribution, revenue, Cost comparison, Margin of safety for making accuratedecisions related to profitability of particular Enterprise

Unit – III

Introduction to Markets, Pricing & Types of Business Organizations: Types of competition, Features of Perfect competition, Monopoly and Monopolistic Competition. Objectives of Pricing- Methods of Pricing: Cost Plus Pricing, Limit Pricing, Market Skimming Pricing, Penetration Pricing, Internet pricing.
Types of Business Organizations: Features of Business, Features and evaluation of Sole Proprietorship, Partnership, Joint Stock Company

Application: Analyze the leaps and bounds faced by the service providers in estimation ofpricing in Telecom sector.

Unit –IV

Capital and Capital Budgeting: Capital and its significance, Types of Capital, Capital process, Methods and sources of raising finance. Capital budgeting-Meaning and Methods of Capital Budgeting: Payback Method, Accounting Rate of Return (ARR) and Net Present Value Method, Internal Rate of Return (IRR) (Simple problems)

Application: Assess long term investments and funds required in small scale organization.

Unit – V

Introduction to Accounting & Financial Analysis:

Accounting objectives, Accounting cycle, GAAP -Double-Entry Book Keeping, Journal, Ledger, Trial Balance-Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simpleadjustments).

Application: Prepare the financial accounting statements like Trading account, Profit and Loss account,Balance sheet of any organization.

Text Books

1. A R Aryasri, "Managerial Economics and Financial Analysis",4th Edition, TMH Publication, 2012.
2. Varshney&Maheshwari, "Managerial Economic Text, problems & Cases", Sultan Chand& Sons Publishers, 2014.

Reference Books:

1. JL Pappas and EF Brigham, "Managerial Economics", Holt-Saunders Publishers, 4th Revised edition, 1st July, 1983.
2. N.P Srinivasn and M. SakthivelMurugan, "Accounting for Management", S. Chand & Publications, 2004.
3. Maheswari S.N., Suneel kK. Maheswari shared K Maheshwari, "An Introduction to Accountancy, Vikas Publishing House, 12th edition, 2018.
4. I.M Pandey, "Financial Management", Vikas Publishing House, 11th Edition, 2015.
5. V. Maheswari K. L. Varshney R.L, "Managerial Economics Text, Problems & Cases", S. Chand & Sons Publications, 2014.

Course code	Course Name	L	T	P	Credits
R23BSH-MA2201	Probability and Statistics	3	0	0	3

Course Objectives:
- To familiarize the fundamental concepts and theories of probability and statistics, including probability distributions, random variables, and descriptive statistics.
- To equip with the skills to collect, organize, analyze, and interpret data using statistical methods, including measures of central tendency, variability, and data handling techniques.
- To develop the skills for making inferences about populations based on sample data, conduct hypothesis tests, and assess the reliability of conclusions drawn from statistical analyses.
- To apply probability and statistical methods to practical problems in computer science, such as machine learning, data mining, and algorithm design.
- To enhance the critical thinking and problem-solving skills by applying statistical reasoning to solve complex problems in engineering and computing.
- To foster critical thinking and logical reasoning skills to approach and solve engineering challenges methodically.

Course Outcomes:
At the end of the course, the students will be able to
1. Apply descriptive statistical methods to summarize, visualize, and interpret data, enabling them to effectively communicate findings and insights in a data-driven context.
2. Apply linear regression models and correlation techniques to decision-making by examining relationships between variables.
3. Analyze real-world engineering problems using the concepts of probability theory and statistical distributions in the process of assessment and decision-making under uncertainty.
4. Analyze data effectively to ensure accurate representation of populations in engineering studies and facilitate decision-making based on statistical inference using large sample tests.
5. Analyze data effectively to ensure accurate representation of populations in engineering studies and facilitate decision-making based on statistical inference using small sample tests.

Unit I

Descriptive statistics and methods for data science: Introduction to Descriptive statistics, Graphical measurements of frequency: histogram, bar chats, polygon, pie charts, measures of central tendency: mean, median, Mode, measures of variability (spread or variance): range, quartile deviation, mean deviation, standard deviation, variance, Moments, moment generating functions, skewness and Kurtosis.

Student Activity: Analyze the data using descriptive statistical methods with any software tools such as R, Python, or Excel.

Unit II

Curve Fitting: Method of Least square Method- Linear curve fitting: Straight line fit for two or more dependent variables. Nonlinear curve fitting: Parabolic fit, fit the curve $y = a\, e^{bx}$, $y = ax^b$.

Correlation and Regression: Correlation, correlation coefficient, rank correlation. Linear regression coefficients, regression lines.

Student Activity: Analyze the data using correlation and Regression with any software tools

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such as R, Python, or Excel.

UNIT III
Probability: Probability, probability axioms, addition law and multiplicative law of probability, conditional probability, Baye's theorem,

Random Variables & Probability Distributions: Random variables (discrete and continuous), probability density functions, properties, mathematical expectation. Probability distribution -Binomial, Poisson distribution and normal distribution-their properties.

UNIT IV
Estimation and Testing of hypothesis, large sample tests: Introduction to Sampling, parameters, statistics, sampling distribution, point estimation, interval estimations, null hypothesis, alternativehypothesis, the critical & acceptance regions, level of significance, type-1 and type-2 of errors.

Large Sample Tests: Test for single proportion, difference of proportions, test for single mean and difference of means, confidence interval for parameters in one sample and two sample problems.

Unit V
Small sample tests: Student t-distribution (test for single mean, two means and paired t-test), testing of equality of variances (F-test). $\chi2$ - test for Single varience, $\chi2$ - test for goodness of fit, ANOVA(1-way).

Text Books:
1. S. C. Guptha and V. K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand and Sons Publications, 2012
2. Veerarajan T., Probability, Statistics and Random Processes, 3rd edition, Tata McGraw-Hill, New Delhi, 2008.
3. Iyengar, T. K.V, Krishna Gandhi, B, et.al, Probability and Statistics, S.Chand 7th edition, 2022.

References:
1. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, 2008.
2. T. K. V. Iyengar, B. Krishna Gandhi and Others, Probability & Statistics, S. Chand &
3. Company.
4. Miller and John E. Freund, Probability & Statistics for Engineers, Prentice Hall of India.
5. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44/e, 2017.
6. Sheldon M. Ross,Introduction to Probability and Statistics for Engineers and Scientists, Academic Press,2009.
7. Ronald E.Walpole, Sharon L.Myers, Keying Ye, Probability and Statistics for Engineers and Scientists, Pearson,2007.
8. Ravichandran, Probability and Statistics for Engineers, Wiley, 2019.

Course Code	Course Name	L	T	P	Credits
R23CSM-PC2201	Machine Learning	3	0	0	3

Course Objectives:

The objectives of the course is to

- Define machine learning and its different types (supervised and unsupervised) and understand their applications.
- Apply supervised learning algorithms including decision trees and k-nearest neighbours (k-NN).
- Implement unsupervised learning techniques, such as K-means clustering.

Course Outcomes:

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

1. Understand different types of machine learning algorithms.
2. Apply classification algorithms and regression algorithms.
3. Apply decision tree algorithms for classification and regression algorithms.
4. Apply supervised machine learning algorithms.
5. Apply Unsupervised machine learning algorithms.

UNIT-I

Introduction to Machine Learning: Evolution of Machine Learning, Paradigms for ML, Learning by Rote, Learning by Induction, Reinforcement Learning, Types of Data, Matching, Stages in Machine Learning, Data Acquisition, Feature Engineering, Data Representation, Model Selection, Model Learning, Model Evaluation, Model Prediction, Search and Learning, Data Sets.

UNIT-II

Nearest Neighbour-Based Models: Introduction to Proximity Measures, Distance Measures, Non-Metric Similarity Functions, Proximity Between Binary Patterns, Different Classification Algorithms Based on the Distance Measures, K-Nearest Neighbour Classifier, Radius Distance Nearest Neighbour Algorithm, KNN Regression, Performance of Classifiers, Performance of Regression Algorithms.

UNIT-III

Models Based on Decision Trees: Decision Trees for Classification, Impurity Measures, Properties, Regression Based on Decision Trees, Bias–Variance Trade-off, Random Forests for Classification and Regression.

The Bayes Classifier: Introduction to the Bayes Classifier, Bayes' Rule and Inference, The Bayes Classifier and its Optimality, Multi-Class Classification | Class Conditional Independence and Naive Bayes Classifier (NBC)

UNIT-IV

Linear Discriminants for Machine Learning: Introduction to Linear Discriminants, Linear Discriminants for Classification, Perceptron Classifier, Perceptron Learning Algorithm, Support Vector Machines, Linearly Non-Separable Case, Non-linear SVM, Kernel Trick, Logistic Regression, Linear Regression, Multi-Layer Perceptron's (MLPs), Backpropagation for Training an MLP.

UNIT-V

Clustering: Introduction to Clustering, Partitioning of Data, Matrix Factorization | Clustering of Patterns, Divisive Clustering, Agglomerative Clustering, Partitional Clustering, K-Means Clustering, Soft Partitioning, Soft Clustering, Fuzzy C-Means Clustering, Rough Clustering, Rough K-Means Clustering Algorithm, Expectation Maximization-Based Clustering, Spectral Clustering.

Text Books:
1. "Machine Learning Theory and Practice", M N Murthy, V S Ananthanarayana, Universities Press (India), 2024

Reference Books:
2. "Machine Learning", Tom M. Mitchell, McGraw-Hill Publication, 2017
3. "Machine Learning in Action",Peter Harrington, DreamTech
4. "Introduction to Data Mining", Pang-Ning Tan, Michel Stenbach, Vipin Kumar, 7th Edition, 2019.

Course Code	Course Name	L	T	P	Credits
R23CSM-PC2202	Java Programming	3	0	0	3

Course Objectives
1. Understand the structure and environment of Java.
2. Implement the relationship between objects.
3. Understand the Strings and Organize data using different data
4. Implement input/output operations and exception handling.
5. Implement multi-threading and GUI applications.

Course Outcomes:
1. Understand the Environment of Java Run-time Environment and Control Structures.
2. Implement real-world objects using class Hierarchies.
3. Implement programs using a collection Framework.
4. Implement exception handling and file handling.
5. Design GUI for real-time problems.

Unit I

Java Environment and Program Structure: History of Java, Features, Applications, Java Installation - JDK and JRE, JVM Architecture, Structure of Java Program, Introduction, Writing Simple Java Program,O OPS Principles, Class and Object, Naming Convention, Data Types, Type Casting, Type Conversion, Wrapper classes, Operators, instance of operator, Command Line Arguments, Decision making, and Looping statements, Arrays.

Unit II

Class Hierarchy & Data Hiding: Property, Method, Constructor, Inheritance (IS-A) , Aggregation and Composition (HAS-A), this and super, static and initialize blocks, Method overloading and overriding, static and final keywords, Types of Inheritance, Compile time and Runtime Polymorphism, Access Specifiers and scope, packages and access modifiers, Abstract class, Interface, Interface Inheritance, Achieving Multiple Inheritance, Class casting, Object Cloning, Inner Classes.

Unit III

Strings and Collections: String: Introduction to Strings, String Methods, StringBuffer and StringBuilder, StringTokenizer**. Collections:** Exploring java.util.*, Scanner, Iterable, Collection Hierarchy, Set, List, Queue and Map, Comparable and Comparator, Iterators: foreach, Enumeration, Iterator and ListIterator.

Unit IV

IO and Error Handling: IO Streams: Exploring java.io.*, Character and Byte Streams, Reading and Writing, Serialization and De-serialization,
Error Handling: Error vs. Exception, Exception hierarchy, Types of Exception, Exception handlers, User defined exception, Exception propagation.

Unit V

Threads and GUI: Multi-Threading: Process vs. Thread, Thread Life Cycle, Thread class and Runnable Interface, Thread synchronization and communication.
GUI: Component, Container, Applet, Applet Life Cycle, Event delegation model, Layouts, Menu, Menu Bar, Menu Item. Introduction to Swings
Applications: Desktop GUI Applications, Mobile Applications, Artificial intelligence, Web applications, Big Data technology, Gaming applications, Business applications, Embedded systems, Cloud applications, Scientific applications,

Text Books
1. The complete Reference Java, 8th edition, Herbert Schildt, TMH.
2. Programming in JAVA, Sachin Malhotra, SaurabhChoudary, and Oxford.

Reference Books

1. Introduction to java programming, 7th edition by Y Daniel Liang, Pearson.
2. Java: How to Program, 9th Edition (Deitel) 9th Edition.
3. Core Java: An Integrated Approach, Java 8 by R. Nageswara Rao.

Course Code	Course Name	L	T	P	Credits
R23CSM-PC2203	Digital Logic & Computer Organization	3	0	0	3

Course Objectives:
The main objectives of the course is to
- Provide students with a comprehensive understanding of digital logic design principles
- Able to design different types of registers and counters using flip flops.
- equip students to design digital circuits using PLDs, understand computer architecture, and program using assembly language.
- Familiarize the concepts of addressing modes, I/O organization, MA
- Illustrate types of memory system, Datapath and control flow for sequencing in processing unit.

Course Outcomes:
1. Explain different combinational logic circuits for the realization of digital logic circuits.
2. Design and implement various synchronous and asynchronous sequential circuits using flip-flops.
3. Design digital circuits using PLDs (PLA, PAL, PROM), comprehend the fundamental structure and operation of computers.
4. Apply different addressing modes and I/O operations to optimize computational processes.
5. Illustrate the concepts of Memory and instruction Set execution in processing unit.

UNIT – I
Digital Logic Circuits-I: 2's Complement and 1's Complement Subtraction of Unsigned Numbers, Signed Binary Numbers, Minimization of Logic expressions using K-Map Simplification up to 4 variable.
Combinational circuits-I Half Subtractor, Full Subtractor, 4-bit Adder & Subtractor , Comparators, .
Applications:
- Efficiently designing digital circuits for arithmetic operations and data processing.
- Developing complex digital systems using minimized logic expressions and universal logic gates.

UNIT – II
Combinational circuits-II: Code Converters, Encoders, Decoders, Multiplexers, De-multiplexers.
Sequential logic circuits: Flip-Flops (SR, JK, T, D), Excitation tables, conversion of Flip Flops, Synchronous and Asynchronous counters, Up/Down counters, Modulus Counters Registers: Bi-directional, Universal Shift Register.
Applications:
- Implementing reliable state machines and timing circuits in digital systems.
- Designing data storage and transfer mechanisms in communication systems.

UNIT – III
Introduction to Programmable Logic Devices (PLDs): PLA, PAL, PROM, Realization of Switching Functions Using PROM, PAL and PLA.
Basic Structure of Computers: Functional unit, Basic Operational concepts, Bus structures, System Software, Performance, Register Transfer Notation, Assembly Language Notation, Basic Instruction Types.

Applications:
- Developing customized logic circuits for specific applications using PLDs.
- Enhancing computer performance and functionality through understanding of basic computer structures and assembly language.

UNIT-IV

MACHINE INSTRUCTION AND I/O ORGANISATION: Component of Instructions: Logic Instructions, shift and Rotate Instructions Type of Instructions: Arithmetic and Logic Instructions, Branch Instructions, Addressing Modes, Input/output Operations, Interrupts: Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Direct Memory Access.

Applications:
- Optimizing CPU performance through efficient use of machine instructions and addressing modes.
- Enhancing system responsiveness and reliability by managing I/O operations and interrupts.

UNIT   -V

MEMORY AND PROCESSING UNIT: Read Only Memory: ROM, PROM, EPROM, EEPROM, Flash Memory, Cache

Memories: Mapping FunctionsSecondary Storage: Magnetic Hard Disks, Optical Disks.

Fundamental Concepts: Register Transfers, Performing an Arithmeticor Logic Operation, Fetching A Word from Memory Execution of Complete Instruction, Hardwired Control, Micro programmed Control

Applications:
- Designing efficient memory hierarchies in computer systems.
- Enhancing CPU performance and instruction execution through optimized control methods

Text Books
1. Computer Organization, Carl Hamacher, ZvonkoVranesic, SafwatZaky, 6th edition, McGraw Hill
2. Digital Design, 6th Edition, M. Morris Mano, Pearson Education.

Reference Books
1. Computer Organization and Architecture, William Stallings, 11thEdition, Pearson.
2. Computer Systems Architecture, M.Moris Mano, 3rdEdition, Pearson
3. Computer Organization and Design, David A. Paterson, John L. Hennessy, Elsevier
4. Fundamentals of Logic Design, Roth, 5thEdition, Thomson

Course Code	Course Name	L	T	P	Credits
R23CSM-PC2204	Java Programming Lab	0	0	3	1.5

Course Objectives
- Understand the structure and environment of Java.
- Implement the relationship between objects.
- Understand the Strings and Organize data using different data
- Implement input/output operations and exception handling.
- Implement multi-threading and GUI applications.

Course Outcomes:
1. Understand the Environment of Java Run-time Environment and Control Structures.
2. Implement real-world objects using class Hierarchies.
3. Implement programs using a collection Framework.
4. Implement exception handling and file handling.
5. Design GUI for real-time problems.

Exercise-1: Programs on Input/output, Class & Object, Type Conversion and Wrapper Classes
Sample Programs
a. Write a Java program to create Class as Registration with properties as Full Name(String), Gender(char), Age(int), Height(double), Phone Number(long), and isMarried(Boolean) and print their values.
b. Write a Java program to implement Type Casting and Conversion.
c. Write a Java program to implement Wrapper Classes.

Exercise-2: Programs on Control Statements, Command Line Arguments, Arrays
Sample Programs
a. Write a Java program to take input as Regd.No and print the branch depending upon
the department code in that Regd.No using else-if and switch statements. (Eg Regd. No: 23KD1A0505, 8th character is department Code, 5-CSE, 4-ECE, 3-MECH, 2-EEE etc.
b. Write a Java program to read input integers from Command Line Arguments and print first and second largest numbers.
c. Write a Java program to take input as Integer array and print even indexed even numbers and odd indexed odd numbers.

Exercise-3: Programs on Control Statements, Operators, Arrays
Sample Programs
a. Write a Java program to take input as Decimal number and convert into Roman Number.
b. Write a Java program to check whether given number is Extension number. The extension number is the number which is present in the last digit(s) of its square.(Eg.N=25, 625 is Extension number since it contains 25).
c. Write a Java program to take input as Amount in rupees and print their denominations and total number notes.

Exercise-4: Programs on Class & Object, Method, Constructor
Sample Programs
a. Create a Class named Student with properties as Student Id, Student Name, gender, department, Age, Aggregate and methods as insertStudent() for inserting student details and displayStudent() for printing student details.
b. Create a class Student with same properties as above and create a constructor to insert student details and return the data using toString() method.

Exercise-5: Programs on Method Overloading, Constructor Overloading
Sample Programs
a. Design a Class named Transaction to transfer amount (double) in different ways using Account Number(int) , Phone Number(Long) and qr Code (String) as parameter into a

method transferAmount() to achieve Method or Constructor OverLoading

b. Design a super Class Account and sub Classes as LoanAccount, SavingsAccount and CurrentAccount and implement relationship between parent and child classes. (Implement Packages for the above classes)

Exercise-6: Programs on Super, Static and Final Keywords
Sample Programs
a. Write a Java program to implement this and super keywords.
b. Write a Java program to implement Static property, method, block and package.
c. Write a Java program to implement final property, method and class.

Exercise-7: Programs on Data abstraction, Inheritance and Interface
Sample Programs
a. Write a Java program to implement Data Abstraction using Abstract class and Interface.
b. Write a Java program to implement Multiple Inheritance through Interfaces.

Exercise-8: Programs on Strings, String Methods, StringBuffer, StringBuilder
Sample Programs
a. Write a Java program to take input as String Sentence S and print largest and shortest word in S.
b. Write a Java program to take input as String S and remove the consecutive repeated characters from S. (Eg. S = Raaaamaaa then, Rama)
c. Write a Java program to take input as String Sentence S and print sentence again with all the words with the first letter as capital letter using StringBuffer.

Exercise-9: Programs on Collections like Maps, Set, List and Comparable & Comparator
Sample Programs
a. Write a Java program to implement Map interface.
b. Write a Java program to implement Set Interface.
c. Write a Java program to implement List Interface.
d. Write a Java program to implement Comparator Interface.

Exercise-10: Programs on IO Streams, Reading & Writing Data, Serialization
Sample Programs
a. Write a Java program to read data from Employee file and print highest salary employee information. (Employee File Contains: ID, name, Dept, Salary).
b. Write a Java program to implements Serializable Interface to read and write Objects to/from the file.

Exercise-11: Programs on Exception Handling (try, catch, throw, throws, finally blocks)
Sample Programs
a. Write a Java program to implement tries, catch, finally blocks.
b. Write a Java program to create user defined Exception and implement throw and throws handlers.

Exercise-12: Programs on Thread, Thread Synchronization
Sample Programs
a. Write a Java program to create Thread using Thread Class and Runnable Interface.
b. Write a Java program to implement multi threading and synchronization.
c. Write a Java program to implement Producer and Consumer Problem.

Exercise-13: Programs on AWT Components, Event Delegation Model, Applets
Sample Programs
a. Create an Applet that changes the Font and background Color depending upon the user selection from the input.
b. Write a Java program to implement Event Delegation model through AWT Components.
c. Write a Java program to implement Layout Manager with AWT components.

Text Books
1. The complete Reference Java, 8th edition, Herbert Schildt, TMH.
2. Programming in JAVA, Sachin Malhotra, SaurabhChoudary, Oxford.

Reference Books
1. Introduction to java programming, 7th edition by Y Daniel Liang, Pearson.
2. Java: How to Program, 9th Edition (Deitel) 9th Edition.
3. Core Java: An Integrated Approach, Java 8 by R. Nageswara Rao.

Course Code	Course Name	L	T	P	Credits
R23CSM-PC2205	Machine Learning Lab	0	0	3	1.5

Course Objectives:
- To learn about computing central tendency measures and Data preprocessing techniques
- To learn about classification and regression algorithms
- To apply different clustering algorithms for a problem.

Course Outcomes:
1. Understand the statistical aspects of algorithms used in pre-processing.
2. Design and evaluate supervised models for classification.
3. Evaluate the machine learning models using unsupervised algorithms.
4. Design and apply clustering algorithms for refinement of the data.
5. Design, develop and test the performance of the machine learning model.

Software Required: Python/R/Weka

Lab should cover the concepts studied in the course work, sample list of Experiments:
1. Compute Central Tendency Measures: Mean, Median, Mode Measure of Dispersion: Variance, Standard Deviation.
2. Apply the following Pre-processing techniques for a given dataset.
    a. Attribute selection
    b. Handling Missing Values
    c. Discretization
    d. Elimination of Outliers
3. Apply KNN algorithm for classification and regression
4. Demonstrate decision tree algorithm for a classification problem and perform parameter tuning for better results
5. Demonstrate decision tree algorithm for a regression problem
6. Apply Random Forest algorithm for classification and regression
7. Demonstrate Naïve Bayes Classification algorithm.
8. Apply Support Vector algorithm for classification
9. Demonstrate simple linear regression algorithm for a regression problem
10. Apply Logistic regression algorithm for a classification problem
11. Demonstrate Multi-layer Perceptron algorithm for a classification problem
12. Implement the K-means algorithm and apply it to the data you selected. Evaluate performance by measuring the sum of the Euclidean distance of each example from its class center. Test the performance of the algorithm as a function of the parameters K.
13. Demonstrate the use of Fuzzy C-Means Clustering
14. Demonstrate the use of Expectation Maximization based clustering algorithm

Course Code	Course Name	L	T	P	Credits
R23CSM-SC2201	NoSQL Databases (Skill Oriented Course)	1	0	2	2

Course Objectives:
- Explore the origins of NoSQL databases and the characteristics that distinguish them from traditional RDBMS.
- Understand the architectures and common features of the main types of NoSQL databases.
- Discuss the criteria that decision makers should consider when choosing between relational and non-relational databases.
- Techniques for selecting the NoSQL database that best addresses specific use cases.

Course Outcomes:
1. Explain and compare different types of NoSQL Databases
2. Compare and contrast RDBMS with different NoSQL databases.
3. Demonstrate the detailed architecture and performance tune of Document-oriented NoSQL databases.
4. Explain performance tune of Key-Value Pair NoSQL databases.
5. Apply NoSQL development tools on different types of NoSQL Databases

Unit I

Overview and History of NoSQL Databases. Definition of the Four Types of NoSQL Database, The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL.

Unit II

Comparison of relational databases to new NoSQL stores, MongoDB, Cassandra, HBASE, Neo4j use and deployment, Application, RDBMS approach, Challenges NoSQL approach, Key-Value and Document Data Models, Column-Family Stores, Aggregate-Oriented Databases. Replication and sharding, MapReduce on databases. Distribution Models, Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication.

Unit III

NoSQL Key/Value databases using MongoDB, Document Databases, Document oriented Database Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, E-Commerce Applications, Complex Transactions Spanning Different Operations, Queries against Varying Aggregate Structure.

Unit IV

Column- oriented NoSQL databases using Apache HBASE, Column-oriented NoSQL databases using
Apache Cassandra, Architecture of HBASE, Column-Family Data Store Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content
Management Systems, Blogging Platforms, Counters, Expiring Usage

Unit V

NoSQL Key/Value databases using Riak, Key-Value Databases, Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preferences, Shopping Cart Data, Relationships among Data, Multi operation Transactions, Query by Data, Operations by Sets. Graph NoSQL databases using Neo4, NoSQL database development tools and programming languages, Graph Databases, Graph Database. Features, Consistency,

Transactions, Availability, Query Features, Scaling, Suitable Use Cases.

Text Books

1. "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Sadalage, P. & Fowler, Addison Wesley Publications,1st Edition, 2012

Reference Books

1. "The Design and Implementation of Modern Column-Oriented Database Systems", Daniel Abadi, Peter Boncz and Stavros Harizopoulas, Now Publishers, 1st Edition, 2013
2. "Next Generation Database: NoSQL and Big Data", Guy Harrison, Apress. 1st Edition, 2015

Course Code	Course Name	L	T	P	Credits
R23CSM-ES2201	Design Thinking for Innovation	1	0	2	2

Course Objectives:
- The objective of this course is to familiarize students with the design thinking process as a tool for breakthrough innovation.
- It aims to equip students with design thinking skills and ignite the minds to create innovative ideas, develop solutions for real-time problems.

Course Outcomes:
1. Explain the fundamentals of Design Thinking and Innovation.
2. Apply the design thinking techniques for solving problems in various sectors.
3. Analyze to work in a multidisciplinary environment.
4. Evaluate the value of creativity.
5. Formulate specific problem statements of real time issues.

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 modelling, 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, Harper Bollins (2009)
2. Idris Mootee, Design Thinking for Strategic Innovation, 2013, John Wiley & Sons.

Reference Books
1. David Lee, Design Thinking in the Classroom, Ulysses press
2. Shrutin N Shetty, Design the Future, Norton Press
3. William Lidwell, Universal Principles of Design- Kritinaholden, Jill Butter.
4. Chesbrough. H, The Era of Open Innovation – 2013

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Web Resources

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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

Subject Code	Subject Name	L	T	P	C
R23CSM-HN2201	Angular JS Framework Honors Course-1(Track-1)	3	0	0	3

Course Objectives:
- To understand model view framework for building applications.
- To create modules for binding the application.
- To understand dependency injection for implementing services.
- To create and establish routes redirects and navigation.
- To validate forms for the submission of data.

Course Outcomes:
1. Understand the fundamentals of Angular JS and its architecture.
2. Apply data binding objects for implementing modules.
3. Implement service and retrieve rest call data.
4. Understand routes and their configuration in angular.
5. Implement form handling with event driven apps.

Unit 1

Angular JS – Introduction to Angular JS, Java Script vs Angular, MVC Framework, Component Based Model, Setting Up the Environment, Installation of Node and NPM, Angular CLI, Creating and Running Project, Add Dependencies, The Anatomy of an AngularJS app, First Application. What is a Component, Create and Start Component.

Unit 2

Data Binding: Introduction to Data Binding, Types of Binding, Binding Data from Component, Async, Template Interpolation, Looping with ngFor, Condition with ngif, Passing inputs and variables to Components, ngModel for 2-way binding, ngOnInit, Styling with components, Creating multiple modules. Combine Forms with Data binding.

Unit 3

Dependency Injection: Understanding Dependency Injection(DI), Services, Creating a Service, Service Injection Context, Rest Calls with HttpClient, Building Angular Project.

Unit 4

Routing & Wrap Up: Introduction to Routing, Angular Project with routing, Creating routes, Route redirects and wild cards, Route Configuration, Static Data in Route, Nested Routing, Navigation Controlling.

Unit 5

Form Handling : Introduction to Form Handling, Template Driven, Form Validation, ng-minlength, ngmaxlength, ng-pattern, ng-required, Submitting Forms, Event Handling with Forms.

Contemporary Topics:
- Pipes
- HTTP Requests
- Authentication
- Angular Modules
- Animations

Applications:
- Online Web Applications
- Financial, Banking Applications and Gateways etc
- Online and Social Media Applications

Text Books:
1. Angular 6 by Example: Get up and running with Angular by building modern realworld web apps, 3rd Edition, by Chandermani Arora.

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2. Pro Angular 6, Apress, by Adam Freeman

REFERENCE BOOKS:

1. Angular JS by Green, Orielly
2. Professional AngularJS (WROX), by Valeri Karpov

Course Code	Subject Name	L	T	P	C
R23CSM-HN2202	Introduction to Networks (ITN) Honors Course-1(Track-2)	3	0	0	3

Course Objectives
- Understand the core components that make up a network, such as devices, protocols, and media.
- Learn how to work with IPv4 addresses, understand subnet masks, and perform subnet calculations to divide networks into smaller logical segments.
- Identify the different cable types and connectors used to connect devices in a local area network.
- Gain hands-on experience setting up basic network connections and performing troubleshooting checks on different operating systems (Windows, Linux, macOS, Android, and iOS)
- Learn about network switches and their role in connecting devices within a network segment and forwarding data packets.
- Learn systematic approaches to identify and resolve network issues.

Course Outcomes:
1. Understand Key network terminology like bandwidth, throughput, and various network types
2. Apply IPv4 addressing and subnet mask concepts to identify network and host information
3. Identify and differentiate between various cables and connectors used in local area networks.
4. Understand with the fundamental knowledge and hands-on skills necessary to identify and troubleshoot network connectivity problems.
5. Implement effective troubleshooting strategies for resolving network connectivity issues.

Unit-I
Standards and Concepts: Identify the fundamental conceptual building blocks of networks - Differentiate between bandwidth and throughput - Differentiate between LAN, WAN, MAN, CAN, PAN, and WLAN - Compare and contrast cloud and on-premises applications and services - Describe common network applications and protocols.

Unit – II
Addressing and Subnet Formats: Compare and contrast private addresses and public addresses - Identify IPv4 addresses and subnet formats - Identify IPv6 addresses and prefix formats.

Unit – III
Endpoints and Media Types: Identify cables and connectors commonly used in local area network - Differentiate between Wi-Fi, cellular, and wired network technologies - Describe endpoint devices - Demonstrate how to set up and check network connectivity on Windows, Linux, Mac OS, Android, and Apple iOS.

Unit – IV
Infrastructure: Identify the status lights on a Cisco device when given instruction by an engineer - Use a network diagram provided by an engineer to attach the appropriate cables - . Identify the various ports on network devices - Explain basic routing concepts - Explain basic switching concepts.

Unit – V
Diagnosing Problems: Demonstrate effective troubleshooting methodologies and help desk best practices, including ticketing, documentation, and information gathering - Perform a

packet capture with Wireshark and save it to a file - Run basic diagnostic commands and interpret the results - Differentiate between different ways to access and collect data about network devices - Run basic show commands on a Cisco network device.

Contemporary Topics need to mention (Compulsory)

Security: Describe how firewalls operate to filter traffic - Describe foundational security concepts - Configure basic wireless security on a home router (WPAx).

<div align="center">Text Books:</div>

1. Introduction to Networks Companion Guide (CCNAv7) Cisco Networking Academy, ISBN-13: 978-0-13-663366-2 ISBN-10: 0-13-663366-8

<div align="center">References Books:</div>

1. CCNA : Cisco Certified Network Associate study guide / Todd Lammle. — 7th ed. Wiley Publishing, Inc. ISBN 978-0-470-90107-6

<div align="center">Weblinks:</div>

1. https://www.ccri.edu/faculty_staff/comp/jmowry/CSCO-1850-PP.html
2. https://examscisco.com/ccna-v7-0/ccna-1-v7-introduction-to-networks-v7-02-itn-exam-answers/

Course Code	Subject Name	L	T	P	C
R23CSM-HN2203	CYBER SECURITY Honors Course-1(Track-3)	3	0	0	3

Course Objectives:
- Understand the fundamental concepts and principles of cybersecurity.
- Understand Security architecture, risk management, attacks, incidents, and emerging IT and IS technologies.
- To Provide the importance of Cyber Security and the integral role of Cyber Security professionals.
- Recognize the importance of cybersecurity in protecting digital assets and information.
- Analyze real-world cyber-attack scenarios and case studies.

Course Outcomes:
1. Understand Cyber Security architecture principles
2. Analyze the System and application security threats and vulnerabilities
3. Estimate operational cyber security strategies and policies.
4. Apply security model to handle mobile, wireless devices and related security issues.
5. Analyze the functionality of Security Technologies and Controls in Cybersecurity

UNIT - I:

Introduction to Cyber Security: Need for Cyber security - History of Cyber security - Defining Cyberspace and Cyber security, scope of Cyber security,Importance of Cyber security in the modern world, Evolution of cyber threats,Importance of Cybersecurity in the digital age.

Foundations of Cyber Security: Cyber Security principles, threat models, and cyber laws. Confidentiality, integrity, and availability (CIA) Triad– Cyber security Framework, Security principles and concepts, Risk management.to better understand the dynamics of Cyber Security.

UNIT-II:

Common Threats and Attack Vectors: Introduction, Proxy Servers and Anonymizers, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks, Social Engineering attacks: Introduction, Phishing, spear phishing, pretexting, Identity Theft (ID Theft).

UNIT-III:

Introduction to Cyber Crime, law and Investigation: Introduction to Cybercrime**,** Definition and scope of cybercrime, Categories of cybercrimes, Impact of cybercrime, Cybercrime and Information Security, classifications of cybercrimes, Cybercrime: The Legal Perspectives, cybercrime and theIndian IT Act 2000, a Global perspective on Cybercrimes.

Cyber laws: Introduction to Cyber Laws, Need for Cyber laws The Indian Context, The Indian IT Act, Challenges to Indian Law and Cybercrime Scenario in India, Consequences of Not Addressing the Weakness in Information Technology Act, Digital Signatures and the Indian IT Act, Information Security Planning and Governance, Information Security Policy Standards.

UNIT-IV:

Cybercrime-Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Authentication Service Security, Attacks on Mobile/Cell Phones.

Mobile Devices: Security Implications for Organizations, Organizational Measures forHandling Mobile Devices-Related Security Issues, Organizational Security Policies andMeasures in Mobile Computing Era, Laptops.

UNIT-V:

Security Technologies and Controls in Cybersecurity: Access control mechanisms, Encryption, Firewalls, intrusion detection systems (IDS), intrusion prevention systems (IPS), NetworkSecurity, Security Information and Event Management (SIEM),functionality of cyber security tools.

Legal and Ethical Aspects of Cyber Security: Laws and regulations governing cyber security,

Ethical considerations in cyber security practices, Privacy issues.

Application:
- Web Firewall
- Antivirus and Antimalware
- Bots
- Threat management systems
- Network Security Surveillance

Contemporary Topics

Critical infrastructure security, Endpoint security, Application security, Cloud security, Diverse Attack Vectors, Supply Chain Attacks.

Text Books:

1. Computer Security: Principles and Practice, Third Edition,William Stallings, Lawrie Brown,Pearson Education, 2014.
2. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole, SunitBelapure, 1st Edition Publication Wiley, 2011.
3. William Stallings, Effective Cybersecurity: A Guide to Using Best Practices and Standards, 1st edition, 2019.
4. Mark Rhodes, Ousley, Information Security, 1st Edition, MGH, 2013.

Reference Books:

1. Principles of Information Security, MichaelE. Whitman and Herbert J. Mattord, CengageLearning.
2. 2. Charles J. Brooks, Christopher Grow, Philip A. Craig, Donald Short, Cybersecurity Essentials, Wiley Publisher, 2018.
3. Yuri Diogenes, ErdalOzkaya, Cyber security - Attack and Defense Strategies, Packt Publishers, 2018.

Weblinks:

1. https://www.cybrary.it/course/entry-level-cybersecurity-training
2. https://www.professormesser.com/security-plus/sy0-601/sy0-601-video/sy0-601-comptia-security-plus-course/
3. https://www.cto.int/strategic-goals/cybersecurity/web-links/

Course Code	Subject Name	L	T	P	C
R23CSM-HN2204	AI for Problem Solving Honors Course-1(Track-4)	3	0	0	3

Course Objectives:

This course deals with
- **Autonomous agent behaviour in solving problems intelligently.**
- **Imagining the consequence of AI decision making system to identify the wide variety of search methods that agents can employ for problem solving.**

Course Outcome:

Students will be able to
1. Understand the philosophy of AI and State Space Search for problem solving.
2. Explore the operations of Heuristic Search and Population Based Methods.
3. Apply various optimal search techniques and Space Saving Algorithms
4. Develop Game Playing Algorithms using planning and decomposition problems.
5. Develop systems using Rule Based Systems and Constraint Satisfaction.

Unit-I

AI Philosophy: Introduction: History, Can Machines think? Winograd Schema Challenge, Language and Thought, Wheels & Gears, **Philosophy**: Mind, Reasoning, Computation, Dartmouth Conference, The Chess Saga, Epiphenomena **State Space Search:** Depth First Iterative Deepening.

Unit-II

Heuristic Search: Best First Search, Hill Climbing, Solution Space, TSP, Escaping Local Optima, Stochastic Local Search. **Population Based Methods**: Genetic Algorithms, SAT, TSP, emergent Systems, Ant Colony Optimization

Unit-III

Finding Optimal Paths: Branch & Bound, A*, Admissibility of A*, Informed Heuristic Functions. **Space Saving Versions of A*:** Weighted A*, IDA*, RBFS, Monotone Condition, Sequence Alignment, DCFS, SMGS, Beam Stack Search

Unit-IV

Game Playing: Game Theory, Board Games and Game Trees, Algorithm Minimax, AlphaBeta and SSS*. **Automated Planning:** Domain Independent Planning, Blocks World, Forward &Backward Search, Goal Stack Planning, Plan Space Planning.
Problem Decomposition: Means Ends Analysis, Algorithm Graphplan, Algorithm AO*

Unit-V

Rule Based Expert Systems: Production Systems, Inference Engine, Match-Resolve-Execute, Rete Net. **Deduction as Search:** Logic, Soundness, Completeness, First Order Logic, Forward Chaining, Backward Chaining. **Constraint Processing:** CSPs, Consistency Based Diagnosis, Algorithm Backtracking, Arc Consistency, Algorithm Forward Checking

Text Book:

1. Deepak Khemani. A First Course in Artificial Intelligence, McGraw Hill Education (India), 2013.

Reference Books:

1. Stefan Edelkamp and Stefan Schroedl. Heuristic Search: Theory and Applications, Morgan Kaufmann, 2011.
2. John Haugeland, Artificial Intelligence: The Very Idea, A Bradford Book, The MIT Press, 1985.
3. Pamela McCorduck, Machines Who Think: A Personal Inquiry into the History and Prospects of Artificial Intelligence, A K Peters/CRC Press; 2 edition, 2004.

4. Zbigniew Michalewicz and David B. Fogel. How to Solve It: Modern Heuristics. Springer; 2nd edition, 2004.
5. Judea Pearl. Heuristics: Intelligent Search Strategies for Computer Problem Solving, Addison-Wesley, 1984.
6. Elaine Rich and Kevin Knight. Artificial Intelligence, Tata McGraw Hill, 1991.
7. Stuart Russell and Peter Norvig. Artificial Intelligence: A Modern Approach, 3rd Edition, Prentice Hall, 2009.
8. Eugene Charniak, Drew McDermott. Introduction to Artificial Intelligence, Addison-Wesley, 1985.
9. Patrick Henry Winston. Artificial Intelligence, Addison-Wesley, 1992.

Link:
1. https://onlinecourses.nptel.ac.in/noc21_cs79/preview