Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Information Technology, Pune-411048

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Curriculum for

SY B. Tech.

Artificial Intelligence

and

Data Science

Pattern 2020

Vision

Excellence in the domain of Artificial Intelligence and Data Science for sustainable development

Mission

M1: To impart quality education with regard to existing and evolving AI & DS techniques.

M2: To groom students technologically superior and ethically strong along with research acumen.

M3: To equip students with interdisciplinary skill sets, require to cater the needs of the society.

Program Educational Objectives

PEO 1: To excel in professional career in Artificial Intelligence and Data Science Engineering and allied interdisciplinary areas.

PEO 2: To reveal strong fundamental foundation supportive for higher education and research.

PEO 3: To instill professional ethics, lifelong learning, leadership qualities and the spirit of team work beneficial towards society and environment.

Program Outcomes

PO1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. Problem Analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

PO3. Design/Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions for complex problems:

PO5. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

At the end of program, students should be able to

- **PSO a:** Apply Data Science techniques to analyze, summarize, and comprehend data pertaining to real life.
- **PSO b:** Apply AI techniques to synthesize given problem and solving it for multi-disciplinary use cases.

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Department of Artificial Intelligence and Data Science

S.Y. B. TECH (Artificial Intelligence and Data Science)

SEMESTER III (PATTERN 2020)

Course Code	Course Title	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
			L	T	P	CIE	ISE	SCE	ESE	PR/OR/TW		
ES21201AD	Discrete Mathematics	TH	3	1	-	20	30	20	30	25	125	4
ADUA21202	Data Structure *	TH	3	-	2	20	30	20	30	25	125	4
ADUA21203	Microprocessors	TH	3	-	2	20	30	20	30	25	125	4
ADUA21204	Database Management System	TH	3	-	2	20	30	20	30	25	125	4
ES20205	Universal Human Values 2	TH	2	1	-	20	30	20	30	25	125	3
ADUA21206	Data Visualization	CE	1	-	4	-	-	-	-	50	50	3
ADUA21207	Data Storytelling	CE	1	-	2	-	-	-	-	50	50	2
	Mandatory Course Environmental Science	AU	-	-	-	-	-	-	-	-	-	-
	Total		16	2	12	100	150	100	150	225	725	24

List of Mandatory Courses:

Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge.

BOS Chairman **Dean Academics** **Director**

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Department of Artificial Intelligence and Data Science

S.Y. B. TECH (Artificial Intelligence and Data Science)

SEMESTER IV (PATTERN 2020)

Course Code	Course Title	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
			L	T	P	CIE	ISE	SCE	ESE	PR/OR/TW		
ES22201AD	Probability and Statistics	TH	3	-	2	20	30	20	30	25	125	4
ADUA22202	Advance Data Structure*	TH	3	-	2	20	30	20	30	25	125	4
ADUA22203	Fundamentals of Computer Networks	TH	3	-	2	20	30	20	30	25	125	4
ADUA22204	Software Engineering	TH	3	-	2	20	30	20	30	25	125	4
ADUA22205	Operating System	TH	3	-	-	20	30	20	30	-	100	3
ADUA22206	Web Technology	CE	1	-	4	-	-	-	-	50	50	3
ES22207AD	Soft Skills	CE	1	-	2	-	-	-	-	50	50	2
	Mandatory Course-Environmental Science	AU	-	-	-	-	-	-	-	-	-	-
	Total		17	0	14	100	150	100	150	200	700	24

List of Mandatory Courses:

Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge.

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SEMESTER III

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Department of Artificial Intelligence and Data Science

ES21201AD: Discrete Mathematics

Teaching Scheme
Credits: 4
Lectures: 3 Hrs/week
Tutorial: 1 Hrs/week

Examination Scheme
Continuous Internal Evaluation (CIE): 20 Marks
In-Semester Examination (ISE): 30 Marks
Skills & Competency Exam (SCE): 20 Marks
End Semester Examination (ESE): 30 Marks
TW: 25 Marks

Home

Prerequisites:

- Basic Mathematics
- Linear Algebra
- Basic Probability

Course Objectives:

- To study basic of logic and set theory
- To understand notion of functions and relations
- To study basic principles of algebraic structures
- To study fundamental principles of graphs
- To study fundamental principles of trees elementary combinatorial processes
- To understand applied discrete mathematics

Course Outcomes:

After completion of the course, student will be able to

1. Demonstrate the use of logical arguments, proof techniques and set theory principles
2. Determine type, properties and solution of relations and functions
3. Demonstrate different algebraic structures
4. Solve the problems using graph methods and algorithms
5. Apply tree models and methods to obtain solutions of applications involving searching, prefix code and vertex connectivity.
6. Determine and enlist the applied discrete mathematics

Unit I:	**Introduction to Discrete Structures and Set Theory**	**[6 Hrs]**
Mathematics and the Notion of Abstraction, Continuous Mathematics and Discrete Mathematics – Discretization, Significance of Discrete Mathematics in Computer Engineering, Continuous Structures and Discrete Structures, Logic – propositional/predicate, Sets and the Need for Sets – Naïve Set Theory (Cantorian Set theory), Axiomatic Set Theory, Need for Sets, Representation of Sets – Enumeration (Tabular Form), Standard Symbols, Set-Builder Notation, Venn Diagram (Venn-Euler Diagram), Types of Sets – Bounded and Unbounded Sets, Countable and Uncountable Sets, Finite and Infinite Sets, Countably Infinite and Uncountably Infinite Sets, Null Set or Empty Set, Universal Set or Universe, Power Set, Operations on Sets – Union, Intersection, Complementation, Symmetric Difference, Cardinality of a Set – Cardinality of a Finite Set, Cardinality of an Infinite Set, Quotient Set, Disjoint Sets, Addition Principle (Inclusion-Exclusion Principle)		

Unit II:	**Relations and Functions**	**[6 Hrs]**

Cartesian Product, Relations, Paths and Digraphs, Properties and Types of Binary Relations, Manipulation of Relations, Transitive Closure and Warshall's Algorithm, Equivalence Relations and Partitions, Partially Ordered Sets (Posets) and Hasse Diagram, Lattices, Chains and Anti-Chains Functions, Types of Functions – One-to-One (Injective), Onto (Surjective) and One-to-One Correspondence (Bijective), Invertible Functions, Mathematical Functions, Exponential and Logarithmic Functions, Recursively Defined Functions, Discrete Numeric Functions, Generating Functions, Recurrence Relations, The Pigeonhole Principle, Ramsey Theory

Case Studies:
Applications of Relations – Electronic Circuit Design, n-Ary Relations and their Applications, Databases and Relations and Structured Query Language (SQL), Applications of Functions – Job Scheduling Problem, Countability of Rational Numbers Using Cantor Diagonalization Argument

Unit III:	**Algebraic Structures and Morphisms**	**[6 Hrs]**

Algebraic Structures with One Binary Operation – Semigroups, Monoids and Groups, Product and Quotient of Algebraic Structures, Isomorphism, Homomorphism and Automorphism, Free Monoids and Languages, Automata, Finite-State Machines, The Monoid of a Finite-State Machine, The Machine of a Monoid, Cyclic Groups and their Application in Fast Adders, Cosets, Normal Subgroups, Codes and Group Codes, Algebraic Structures with Two Binary Operations –Rings, Integral Domains and Fields, Boolean Algebra and Boolean Ring

Unit IV:	**Graph Theory**	**[6 Hrs]**

Graphs, types of graphs, representation of graph, Paths and Circuits – Eulerian and Hamiltonian Planer Graphs, Graph Colouring, Isomorphism of Graphs, Subgraphs and isomorphism of Subgraphs
Case Study: Usage of graph in real time applications

Unit V:	**Trees**	**[6 Hrs]**

Trees and Weighted Trees, Spanning Trees and Minimum Spanning Trees, Prim's and Kruskal's Algorithm, Isomorphism of Trees and Subtrees, Prefix Codes, Case Study: Usage of trees in real time applications

Unit VI:	**Galois Theory and Applied Discrete Mathematics**	**[6 Hrs]**

Galois Theory – Connection Between Field Theory and Group Theory ,Finite Projective Geometry – Finite Geometry, Projective Geometry over Finite Fields, Axioms of Projective Geometry, Use of Finite Projective Geometry in the Development of the Fastest Indian Supercomputer *Eka* by Dr. Narendra Karmarkar – An Interconnection Scheme Between n Processors and m Memory Modules that Reduce the Number of Connections from mn to $O(3n)$, Applications of discrete mathematics in mathematical modelling, image processing and Artificial Intelligence and allied fields

Applied Discrete Mathematics
Mathematical modelling for any problem statement. Signal Processing on Graphs, Image Processing on Arbitrary Graphs, Applications of Graph Theory in Software – Graph Database, Web Graph, Applications of Graph Theory in Hardware – Register Allocation by Graph Colouring, Floor planning

Text Books:

	1	Bernard Kolman, Robert C. Busby and Sharon Ross, *Discrete Mathematical Structures*, Prentice-Hall of India Private Limited.

	2	Alan Doerr and Kenneth Levasseur, *Applied Discrete Structures for Computer Science*, Galgotia Publications Pvt. Ltd.
	3	C. L. Liu, *Elements of Discrete Mathematics*, Tata McGraw-Hill.
Reference Books:		
	1	Dr. K. D. Joshi, *Foundations of Discrete Mathematics*, New Age International Limited, Publishers, January 1996.
	2	Richard Johnsonbaugh, *Discrete Mathematics*, Pearson.
	3	Kenneth H. Rosen, *Discrete Mathematics and its Applications*, Tata McGraw-Hill.
	4	Norman L. Biggs, *Discrete Mathematics*, Oxford University Press.

List of Assignments: Tutorials to be conducted based on:

1 Explain principle of counting by relating examples of programming construction and programming paradigm

2 Apply and prove with the help of principle of induction to generate set of natural number giving reminder 1 when divide by 3 and also derive the recurrence relation for the same.

3 Prepare presentation to demonstrate predicate and proportional logic.

4 Explain different properties of relation by giving real world example in computing.

5 Explain with example use of lattice in real world problem solving.

6 Explain with example of groups and rings in cryptography.

7 Write a program to calculate Indegree and outdegree of node in directed and undirected graph with adjacency matrix.

8 Write a program to calculate no of nodes, depth and height, no of nodes at level I for binary tree.

9 Select the data set and build mathematical model by applying discreate mathematics

10 Explore application of probability and conditional probability to model in pandemic.

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Department of Artificial Intelligence and Data Science

ADUA21202: Data Structure

Teaching Scheme

Credits: 4

Lectures: 3 Hrs/week

Practical: 2 Hrs/week

Examination Scheme

Continuous Internal Evaluation (CIE): 20 Marks

In-Semester Examination (ISE): 30 Marks

Skills & Competency Exam (SCE): 20 Marks

End Semester Examination (ESE): 30 Marks

OR: 25 Marks

Prerequisites:

- Fundamentals of Programming

Course Objectives:

- To understand the different ways of data representation
- To understand the different ways of data representation
- To study linear data structures and their applications.
- To understand concepts about searching and sorting techniques.
- To build problem solving skills with the help of fundamental data structures.

Course Outcomes:

After completion of the course, student will be able to

1. Understand arrays and their implementation with basics of algorithm analysis
2. Synthesize and analyze algorithms with respect to time and space Complexity
3. Apply various linear data structures using sequential and linked organization for problem solving and programming
4. Apply advanced linear data structure stacks and queues for problem solving and programming
5. Select appropriate searching and/or sorting techniques in the application Development

Unit I:	**Introduction to Data Structures**	**[6 Hrs]**
Concept of data, functions, difference between compiler and interpreter, Abstract Data Types (ADT), data structure and its types, Difference between individual variables against Data Structures, Array, Pointers, Analysis of algorithm (Frequency count method), Big Oh, Theta and Omega definitions, Big Oh Analysis		
Unit II:	**Concept of sequential organization**	**[6 Hrs]**
Concept of Linear data structures, Concept of ordered list, Storage representations of ordered list such as row major, column major and their address calculation. Representation of sparse matrix using arrays, application of array in polynomial representation and algorithm for sparse matrix addition, multiplication, simple and fast transpose, pointer to an arrays, array of pointers, String Manipulation.		
Unit III:	**Searching, sorting and hashing techniques**	**[6 Hrs]**
Linear & Binary search, Bubble sort, Selection sort, Insertion Sort, Merge Sort, Quick Sort & complexity Analysis of algorithms. **Hash tables:** Basic concepts, Hash function, collisions, Collision resolution techniques, Applications		

Unit IV:	**Linear Data Structure- Linked Lists**	**[6 Hrs]**
Concept, Comparison of Sequential and linked organizations, Linked list as an ADT, Singly Linked List, Doubly Linked List and Circular Linked Lists with all operations like Creations, insertion (all positions), Deletion (all positions), Modify, Merge and Reverse(SLL).		
Unit V:	**Linear Data Structures –Stack**	**[6 Hrs]**
Stacks: Concept of stack, Stack as an ADT, push and pop operation, Stack implementation using array and linked list, application of stack for expression conversion (numerical infix-postfix, prefix and (numerical postfix) evaluation, Recursion concept and use of internal stack		
Unit VI:	**Linear Data Structures-Queue**	**[6 Hrs]**
Concept of queue, Queue as an ADT, Linear queue implementation using array and linked list, Circular queue, Priority queue, doubly ended queue, Multi-queues, Applications of Queue.		

Text Books:

	1	Horowitz and Sahani, ―Fundamentals of Data Structures in C++, University Press, ISBN 10: 0716782928 ISBN 13: 9780716782926.
	2	R. Gillberg, B. Forouzan, ―Data Structures: A Pseudo code approach with C, Cenage Learning, ISBN 9788131503140.
	3	A. Tanenbaum, Y. Langsam, M. Augenstein: Fundamentals of Data Structure, 2nd edition, Pearson Education, 2002, ISBN-81-7808-670-0.

Reference Books:

	1	M. Weiss, ―Data Structures and Algorithm Analysis in C++, 2nd edition, Pearson Education, 2002, ISBN-81-7808-670-0.
	2	Introduction to Algorithms 3rd Edition by Thomas H. Cormen, Charles E.Leiserson,Ronald L Rivest,& Clifford Stein, MIT Press ,Cambridge MA USA ,ISBN 978-81-203-4007-7
	3	Aho, J Hopcroft, J.Ulman, "Data Structures and Algorithms", Pearson Education, 1998, ISBN-0-201-43578-0

List of Assignments (C/C++): Application based

1 Perform the string operations with and without pointers: 1. Length. 2. Copy. 3. Concat. 4. Reverse.

2 Accept conventional matrix and convert it into sparse matrix. Implement simple transpose and Fast transpose algorithm on sparse matrix.

3 Create a database using array of structures and perform following operations on it: i.Add record ii. Display Database iii. Search record (binary search) iv. Delete record
Create a Singly linked list for employee data and perform a. insertion b. deletion c. search d. modify

4 Implement polynomial using Doubly Linked List and perform Addition/Multiplication of Polynomials

5 Implement polynomial using Doubly/Circular Linked List and perform Evaluation of polynomial

6 Perform implementation of STACK using array
Push an element on to stack
Pop an element

Demonstrate overflow simulations on stack
Display stack

7 Perform implementation of STACK using Linked List
Push an element on to stack
Pop an element
Demonstrate overflow simulations on stack
Display stack

8 Implement stack for expression conversion (infix to postfix)

9 Perform implementation of Queue using array and Linked List
Enqueue
Dequeue

10 Pizza parlor accepting maximum n orders. Orders reserved in FCFS basis. Order once placed can't be cancelled. Write C++ program to simulate the system using circular Queue.
Sort the data in ascending order using Bubble sort (Display pass by pass output) and search a particular data using Binary search.
OR
Implement Quick Sort to sort the given list of numbers. Display Corresponding list in each pass

11 Sort the data in ascending order using Selection sort (Display pass by pass output) and search a particular data using binary search.
OR
Implement Quick sort to sort the given list of numbers.
Display corresponding list in each pass.

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ADUA21203: Microprocessors

Teaching Scheme
Credits: 4
Lectures: 3 Hrs/week
Practical: 2 Hrs/week

Examination Scheme
Continuous Internal Evaluation (CIE): 20 Marks
In-Semester Examination (ISE): 30 Marks
Skills & Competency Exam (SCE): 20 Marks
End Semester Examination (ESE): 30 Marks
TW: 25 Marks

Home

Prerequisites:

- Computer fundamentals

Course Objectives:

- To study pipelined architecture in microprocessors.
- To explain the function of each element of a memory hierarchy, identify and compare different methods for computer I/O.
- To understand various computer arithmetic techniques.
- To identify the elements of modern instructions sets and explain their impact on processor design.
- To study memory management and protection mechanism in microprocessor.

Course Outcomes:

After completion of the course, students will be able to

1. Determine the use of pipelined Architecture.
2. Draw the concepts of memory and I/O Systems.
3. Solve numerical Problems using computer arithmetic techniques.
4. Understand the architecture of the advanced microprocessor thoroughly to use the resources for programming.
5. Explain memory management and protection mechanism of the advanced processor.

Unit I:	**Processor Organization**	**[6 Hrs]**
Basic organization of computer, Block level description of the functional units, Register organization-User visible registers, Control and Status registers, Instruction Cycle-Indirect cycle and Data flow, Timing diagram, Instruction Pipelining- Pipelining Strategy, Pipeline performance, Pipeline hazards, Fundamental Concepts- Register transfer, performing arithmetic or logic operations, fetching a word from memory, Storing a word in memory.		
Unit II:	**Memory Organization**	**[6 Hrs]**

Characteristics of memory system, the memory hierarchy, Cache Memory- Cache memory principles, Replacement algorithms, write policy, one level and two-level cache, I/O modules Module function and I/O module structure, Programmed I/O, Interrupt driven I/O.		
Unit III:	**Computer Arithmetic Techniques**	**[6 Hrs]**
The Arithmetic and Logic Unit, Multiplication of positive numbers, Signed operation and multiplication, Booths algorithm, Integer division, Floating point representation–IEEE standard.		
Unit IV:	**Introduction to Microprocessors**	**[6 Hrs]**
Introduction, Architecture of 8086 and 80386DX, 80386: Register set, Flags, Physical address space, Data types, operating modes, Addressing Modes and Instruction Set.		
Unit V:	**Memory Management**	**[6 Hrs]**
Memory Management in 80386-Segment Translation, Page Translation, Combining Segment and Page translation.		
Unit VI:	**Protection**	**[6 Hrs]**
Protection: Need of Protection, Overview of 80386 DX protection Mechanism, Privilege levels. Segment level protection, page level protection, combining segment and page level protection.		
Text Books:		
	1	W.Stallings, ―Computer Organization and Architecture: Designing for performance, Pearson Education/ Prentice Hall of India, 2003, ISBN 978-93-325-1870-4, 7th Edition**.**
	2	Zaky S, Hamacher, ―Computer Organization‖,5th Edition, McGraw-Hill Publications, 2001, ISBN-978-1-25-900537-5, 5thEdition.
	3	Douglas Hall, "Microprocessors & Interfacing", McGraw Hill, Revised 2nd Edition,2006 ISBN 0-07-100462-9.
	4	James L Turley, - Advanced 80386 programming techniques, Tata McGraw-Hill Education.
	5	80386, Programmers Reference manual, Intel.
Reference Books :		
	1	John P Hays,―Computer Architecture and Organization‖,McGraw Hill Publication, 1998, ISBN:978-1-25-902856-4, 3rdEdition.
	2	Intel64andIA-32-bit architectures Software Developer's Manual, Volume 3A,Intel.
	3	A.Ray, K.Bhurchandi, "Advanced Microprocessors and peripherals: Arch, Programming & Interfacing",Tata McGraw Hill,2004ISBN0-07-463841-6

List of Assignments:

1. Multiply the following using Booth's
   Algorithm Multiplicand =+ 11
   Multiplier = - 6
2. Perform Division of following numbers using Restoring Division
   Algorithm Dividend = 1011
   Divisor= 0011
3. Write 64-bit ALP to "Hello World" in NASM
4. Write 64-bit ALP to accept number and display it on screen.
5. Write 64-bit ALP to convert HEX4-digit input to BCD 5-digit output.
6. Write64-bit ALP to accept the numbers from user and perform addition of 2 numbers and display the result on screen.
7. Write 64-bit ALP to perform following string operations
   i) Length of String
   ii) Reverse of String
8. Write 64-bit ALP to perform multiplication of two 8-bit hexadecimal number with successive addition.

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ADUA21204: Database Management System

Teaching Scheme
Credits: 4
Lectures: 3 Hrs/week
Practical: 2 Hrs/week

Examination Scheme
Continuous Internal Evaluation (CIE): 20 Marks
In-Semester Examination (ISE): 30 Marks
Skills & Competency Exam (SCE): 20 Marks
End Semester Examination (ESE): 30 Marks
OR: 25 Marks

Home

Prerequisites:

- Fundamentals of Programming

Course Objectives:

- To understand the fundamental concepts of database management
- To provide a strong formal foundation in database concepts, technology.
- To give systematic database design approaches covering conceptual design, logical design and an overview of physical design.
- To learn basic issues of transaction management and concurrency control
- To learn and understand various Database Architectures and Applications
- To learn a powerful, flexible and scalable general-purpose database to handle big data

Course Outcomes:

After completion of the course, student will be able to

1. Demonstrate functions of DBMS and RDBMS.
2. Implement SQL DML/DDL queries and PL/SQL procedures and functions.
3. Apply concept of normalization in RDBMS.
4. Apply ACID properties for transactions.
5. Use of database architecture for applications.
6. Understand concept of Big Data and NOSQL.

Unit I:	**Introduction to DBMS**	**[6 Hrs]**
Introduction to Database Management Systems, Advantages of a DBMS overfile-processing Systems, Database-System purpose and applications, Levels of Database Systems, Database Languages, Data Models, Components of a DBMS and overall structure of a DBMS, Database Design and ER Model: Entity, Attributes, Relationships, Constraints, types of Keys, Design Process, Entity Relationship Model, ER Diagram, Design Issues, Extended E-R Features, converting E-R & EER diagram into tables.		
Unit II:	**Relational Algebra, SQL and PL/SQL**	**[6 Hrs]**

Introduction to Relational Algebra and Calculus, SQL: Characteristics and advantages, SQL Data Types and Literals, DDL, DML, DCL, TCL, SQL Operators, Tables: Creating, Modifying, Deleting, Views: Creating, Dropping, Updating using Views, Indexes, SQL DML Queries: SELECT Query and clauses, Set Operations, Predicates and Joins, Set membership, Tuple Variables, Set comparison, Ordering of Tuples, Aggregate Functions, Nested Queries, Database Modification using SQL Insert, Update and Delete Queries. PL/SQL: Concept of Stored Procedures and Functions, Cursors, Triggers, Roles and Privileges, Embedded SQL, Dynamic SQL		
Unit III:	**Relational Database Design**	**[6 Hrs]**
Relational Model: Basic concepts, Attributes and Domains, CODD's Rules, Functional Dependencies: Basic concepts, closure of set of functional dependencies, closure of attribute set, canonical cover, Decomposition: lossless join decomposition and dependency preservation, The Process of normalization, 1NF, 2NF,3NF, BCNF,4NF, 5NF.		
Unit IV:	**Database Transactions and Query Processing**	**[6 Hrs]**
Basic concept of a Transaction, Transaction Management, Properties of Transactions, Concept of Schedule, Serial Schedule, Serializability: Conflict and View, Testing conflict and view serializability, Recoverable and Non-recoverable Schedules, Concurrency Control: Need, Locking Methods, Deadlocks, Time stamping Methods, Different Crash Recovery methods such as Shadow-Paging and Log-Based Recovery: Deferred and Immediate, Checkpoints, Introduction to Query Processing and Query Optimization, Performance Tuning in SQL.		
Unit V:	**Database architecture**	**[6 Hrs]**
Introduction to Database Architectures: Multi-user DBMS Architectures, Parallel Databases: Speedup and Scale up, Architectures of Parallel Databases. Distributed Databases: Architecture of Distributed Databases, Distributed Database Design, Distributed Data Storage, Distributed Transaction: Basics, Failure modes, Commit Protocols, Concurrency Control in Distributed Database.		
Unit VI:	**Advances in Databases and Big Data**	**[6 Hrs]**
Introduction to NoSQL, Structured verses Unstructured data, Different NoSQL Data Models, NoSQL using Mongo DB, CAP theorem and BASE Properties, Comparative study of SQL and NoSQL, Introduction to Big Data, HADOOP- Building blocks of Hadoop, components of Hadoop-HDFS, MapReduce, HBASE, HIVE		

List of assignments

1. Design and Develop SQL DDL statements which demonstrate the use of SQL objects such as Table, View, Index, Sequence, Synonym
2. Design at least 10 SQL queries for suitable database application using SQL DML statements: Insert, Select, Update, delete with operators, functions, Set operators, Clauses.
3. Design at least 10 SQL queries for suitable database application using SQL DML statements: all types of Joins, Sub-Query and View.

4 Write a PL/SQL code to implement all types of cursors (Implicit, Explicit) and display employee number, name and salary of 5 highest paid employees using cursor. Employee (employeeno, employeename, join_date, designation, salary).

5 PL/SQL Stored Procedure and Stored Function: Write a PL/SQL procedure to find the number of students ranging from 100-80%, 79-70% ,69-60%, 59-50 & below 49% in each course from the Student_course table given by the procedure as parameter. Student_course (Roll_no, Course, Couse_code, Semester,Total_ Marks, Percentage)

6 Database Trigger(Row level and Statement level triggers, Before and After Triggers):

Write a database trigger on Employee table. The System should keep track of the records that are being updated or deleted. The old value of updated or deleted records should be added in to a new table when the Employee table is updated. Employee(employeeno, employeename, join_date, designation, salary).

7 Design and Develop Mongo DB Queries using CRUD operations.

8 Implement aggregation and indexing with suitable example using Mongo DB.

9 Implement Map reduce operation with suitable example using MongoDB.

10 Implement MYSQL database connectivity with Java for Database navigation operations such as insert, delete, and update etc. using ODBC/JDBC.

Text Books:	
1	Abraham Silberschatz, Henry Korth, S.Sudarshan," Database System concepts",5th Edition, McGraw Hill International Edition.
2	Elmasri R.,Navathe S.," Fundamentals of Database Systems", 4*Edition, Pearson Education,2003,ISBN 8129702282.
3	Pramod J.Sadalage and Martin Fowler,—NoSQL Distilled‖, Addison Wesley,ISBN10:0321826620,ISBN-13: 978-0321826626
4	"Managing and Using MySQL", Reese G., Yarger R., King T., Williums H, 2nd Edition,Shroff Publishers and Distributors Pvt.Ltd.,ISBN81 -7366 - 465–X
5	Mongo DB: The Definitive Guide by Kristina Chodorow
Reference Books:	
1	Ramkrishna R.,Gehrke J., "Database Management Systems", 3rd Edition, McGraw-Hill, 2003, ISBN 0-07-123151 –X.
2	CJDate, —An Introduction to Database Systems ,Addison-Wesley, ISBN:0201144719.
3	Connally T., BeggC., "Database Systems", 3rd Edition, Pearson Education, 2002, ISBN81-7808-861-4
4	Mongo DB, O'Reilly Publications.
5	Hadoop, O'Reilly Publications.
6	http://docs.mongodb.org/manual/orSQL/XML/MongoDB(https://www.w3schools.com/)

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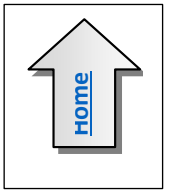
Department of Artificial Intelligence and Data Science

ES20205: Universal Human Values 2

Teaching Scheme
Credits: 3
Lectures: 2 Hrs/week
Tutorial: 1 Hr/week

Examination Scheme
Continuous Internal Evaluation (CIE): 20 Marks
In-Semester Examination (ISE): 30 Marks
Skills & Competency Exam (SCE): 20 Marks
End Semester Examination (ESE): 30 Marks
Term Work: 25



Prerequisites:

- Universal Human values 1

Course Objectives:

The objective of the course is fourfold:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- Understanding of the harmony in the human being, family, society and nature/existence.
- Strengthening of self-reflection.
- Development of commitment and courage to act.

Course Outcomes:

After completion of the course, student will be able to

1. Become more aware of themselves, and their surroundings family, society, nature.
2. Become more responsible in life.
3. To handle problems with sustainable solutions.
4. Have better critical ability.
5. Become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
6. To apply what they have learnt to their own self in different day-to-day settings in real life.

Unit I:	**Introduction - Need, Basic Guidelines, Content and Process for Value Education**	**[6 Hrs]**

Purpose and motivation for the course, Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations,

Right understanding, Relationship and Physical Facility- the basic requirements for fulfillment of aspirations of every human being with their correct priority,

Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Unit II:	**Understanding Harmony in the Human Being - Harmony in Myself!**	**[6 Hrs]**

Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' - happiness and physical facility, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I',

Understanding the harmony of I with the Body, correct appraisal of Physical needs, meaning of Prosperity in detail.

Unit III:	**Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship**	**[6 Hrs]**

Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness, Trust and Respect as the

foundational values of relationship

Understanding the meaning of Trust; Difference between intention and Competence,

Understanding the meaning of Respect, Difference between respect and Differentiation; the other salient values in relationship,

Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals,

Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family

Unit IV:	**Understanding Harmony in the Nature and Existence - Whole existence as Coexistence with Implications of the Holistic Understanding of Harmony on Professional Ethics**	**[6 Hrs]**

Natural acceptance of human values , Definitiveness of Ethical Human Conduct,

Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in professional ethics:

a. Ability to utilize the professional competence for augmenting universal human order

b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems,

c. Ability to identify and develop appropriate technologies and management patterns for above production systems.

Discussion on the conduct as an engineer or scientist.

Text Books :		
	1	Human Values and Professional Ethics by R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010
Reference Books :		
	1	Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
	2	Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
	3	The Story of Stuff (Book).
	4	The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi.
	5	Small is Beautiful - E. F Schumacher.
	6	Slow is Beautiful - Cecile Andrews
	7	Economy of Permanence - J C Kumarappa
	8	Bharat Mein Angreji Raj – Pandit Sunderlal
	9	Rediscovering India - by Dharampal
	10	Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
	11	India Wins Freedom - Maulana Abdul Kalam Azad
	12	Vivekananda - Romain Rolland (English)
	13	Gandhi - Romain Rolland (English)

List of Assignments: (Any 7 Tutorials can be taken)

1. Practice session to discuss natural acceptance in human being.
2. Practice session to discuss the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.
3. Practice session to discuss the role others have played in making material goods available to me.

Identifying from one's own life.

4 Practice session to differentiate between prosperity and accumulation.

5 Practice session to discuss program for ensuring health vs dealing with disease.

6 Practice session to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc.

7 Practice session to reflect on Gratitude as a universal value in relationships. Discuss with scenarios.

8 Practice session to reflect on Gratitude Elicit examples from students' lives.

9 Practice session to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

10 Case Study session e.g. to discuss the conduct as an engineer or scientist etc.

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ADUA21206: Data Visualization

Teaching Scheme
Credits: 3
Lectures: 1 Hrs/week
Practical: 4 Hrs/week

Examination Scheme
Continuous Internal Evaluation (CIE): -
In-Semester Examination (ISE): -
Skills & Competency Exam (SCE): -
End Semester Examination (ESE): -
TW: 50 Marks

Prerequisites:

- Fundamentals of programming

Course Objectives:

- To understand components of data visualization
- To learn various tools and techniques of data visualization.

Course Outcomes:

After completion of the course, student will be able to

1. Design and create data visualizations.
2. Apply data visualization techniques in various domains.

Unit I:	**FOUNDATIONS OF DATA VISUALIZATION**	**[6 Hrs]**
Overview of Data Visualization, Need of data visualization, The Human Brain and Data Visualization, The Shapes of Data, Inputs for data visualization, Types of Visualizations: Cognitive vs Perceptual Design Distinction, Examples of the Types of Visualizations, 5 big data visualization categories: temporal, hierarchical, network, multi-dimensional and geospatial, Practicing Good Ethics in Data Visualization, Ineffective Visuals and How to Improve Them, Principles of Visual Perception, Color as a Pre-Attentive Attribute, Strategic Use of Contrast, Tools for Visualizing: PowerBI, Tableau etc., case study.		
Unit II:	**BEST PRACTICES OF DATA VISUALIZATION**	**[6 Hrs]**
Gestalt Principle: Proximity, Accessible Visualizations, Aesthetic, Design and Exploratory Analysis Introduction, Exploratory and Explanatory Analysis, Data, Relationships and Design Static Versus Interactive Visualizations, Bringing everything together in a dashboard, Moving from Foundational to Advanced Visualizations: Bar charts, Gantt charts, Stacked bars, Tree maps, Area charts, Pie charts; Visualizing distributions: Circle charts, Jittering, Box and whisker plots, Histograms.		

Text Books:		
	1	Fundamentals of Data Visualization by Claus O. Wilke, April 2019, O'Reilly Media, Inc., ISBN: 9781492031086
	2	Communicating Data with Tableau: Designing, Developing, and Delivering Data Visualizations, Ben Jones
Reference Books:		
	1	The Big Book of Dashboards, Steve Wexler, Jeffrey Haffer, Andy Cotgreave
	2	Practical Tableau, Ryan Sleeper
	3	https://www.tableau.com/learn/articles/interactive-map-and-data-visualization-examples

	4	Tableau for Beginners – Data Visualisation made easy: https://www.analyticsvidhya.com/blog/2017/07/data-visualisation-made-easy/
	5	https://rafalab.github.io/dsbook/ggplot2.html#aesthetic-mappings

List of Assignments:

1 Case study: Compare various data visualization tools. Study any one of the tools in detail.

2 Download any free dataset (from Kaggle/tableau etc.) in excel format. Explore and analyse this data using Excel or simply by hand (drawing pictures is fine).

3 Visualize the downloaded dataset from assign2 by applying following graph types: (select any 8)

1. Bar Chart
2. Line Chart
3. Scatterplot
4. Sparkline
5. Pie Chart
6. Gauge
7. Waterfall Chart
8. Funnel Chart
9. Heat Map
10. Histogram
11. Box Plot
12. Maps
13. Tables
14. Indicators
15. Area Chart
16. Radar or Spider Chart
17. Tree Map

4 Download any free dataset (from Kaggle/ tableau etc.) and visualize using temporal category: Scatter plots, Polar area diagrams, Time series, sequences, Line graphs.

5 Visualize the dataset using temporal category and Timelines tools

6 Visualize the dataset using hierarchical category: Tree diagrams and Ring charts

7 Visualize the dataset using multidimensional category: Scatter plots, Pie charts, histograms

8 Plot the visualization graph using aesthetics, labels and titles, categories as colours

9 Illustrate a density map for any geospatial dataset. (source:https://data.world/datasets/geospatial)

10 Mini-project: Create a dashboard by applying maximum learnt visualization techniques.

11 Visualization of dataset using Python/R

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Department of Artificial Intelligence and Data Science

ADUA21207: Data Storytelling

Teaching Scheme

Credits: 2

Lectures: 1 Hrs/week

Practical: 2 Hrs/week

Examination Scheme

Continuous Internal Evaluation (CIE):-

In-Semester Examination (ISE):-

Skills & Competency Exam (SCE):-

End Semester Examination (ESE):-

TW: 50 Marks

Prerequisites:

- Familiarity with structured data

Course Objectives:

- To enable the students to get acquainted with the context of the data
- To learn various approaches to gain data insights
- To enable transformation of insights to story and its presentation

Home

Course Outcomes:

After completion of the course, student will be able to

1. Understand the data analysis with context of the data
2. Explore and create insights for target audience
3. Summarize the metrics towards desired performance

Unit I:	**Introduction to data storytelling**	**[3Hrs]**
Need of storytelling, the psychology and anatomy of storytelling, how data is communicated, understanding the target audience, impact of storytelling, case studies.		
Unit II:	**Discovering the persona, intent and data**	**[3Hrs]**
Exploring and discovering data, types of data, ways of data analysis with respect to audience, context of the audience, problems, action and impact.		
Unit III:	**Formulating insights, defining storyline**	**[3Hrs]**
Capturing the insights, valuable insights, focus of data points, evaluation of the data for better insights, defining the structure of the storyline, creation of the storyline for analysis		
Unit IV:	**Designing and delivering the storyline**	**[3Hrs]**
Format of the story, determining best visualization, selection of appropriate design, Ways of delivering the storyline, the narration, visuals: setting the scenes, polishing the scenes		
Text Books :		
	1	Storytelling with data, cole nussbaumer knaflic, Wiley

	2	Storytelling with data, lets practice, cole nussbaumer knaflic, Wiley
Reference Books:		
	1	Effective Data Storytelling: How to Drive Change with Data, Narrative and Visuals, Brent Dykes, Wiley
	2	Data Story: Explain Data and Inspire Action Through Story, Nancy Duarte.

List of Assignments: (to be framed based on following, interactive – use of excel for assignment)

1. Study/generation/summarization of the data, understanding audience and framing the problems with action and impact.
2. Formulating the insights with presentation/static charts and defining the structure of storyline.
3. Analyzing, Designing and delivering the story.

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SEMESTER-IV

Bansilal Ramnath Agarwal Charitable Trust's
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ES22201AD: Probability and Statistics

Teaching Scheme
Credits: 4
Lectures: 3 Hrs/week
Practical: 2 Hrs/week

Examination Scheme
Continuous Internal Evaluation (CIE): 20 Marks
In-Semester Examination (ISE): 30 Marks
Skills & Competency Exam (SCE): 20 Marks
End Semester Examination (ESE): 30 Marks
TW: 25 Marks

Prerequisites:

- Basics of Mathematics

Course Objectives:

- To give an exposure to the students the basic concepts of Probability and Statistical methods and their application.
- To serve as a foundation to analyze problems in Science and Engineering applications through Statistical testing Method.
- To introduce computing with R

Home

Course Outcomes:

After completion of the course, student will be able to

1. Understand basics of probability including conditional probability and Bayes rule
2. Solve basic problems arising in engineering that involve discrete and continuous probability distributions.
3. Perform hypothesis testing with theory of estimation
4. Use statistical concepts such as means, variances and various types of graphs to analyze datasets using computational software such as R Perform various tests of hypothesis and significance
5. Understand confidence intervals and perform statistical inference such as hypothesis testing and regression

Unit I:	**Basic Ideas in Probability**	**[6 Hrs]**
Experiments, Outcomes and Probability, Events, Conditional Probability, Bayes theorem, Random Variables and Expectations		
Unit II:	**Probability distributions**	**[6 Hrs]**
Discrete Distributions: Binomial distribution, Poisson's distribution, Continuous Distributions: Normal Distribution, joint probability distribution		
Unit III:	**Markov Chains and Hidden Markov Models**	**[6 Hrs]**
Markov Chains, Estimating Properties of Markov Chains, Hidden Markov Models and Dynamic Programming, Introduction to Stochastic Processes – Markov process classification of states – Examples of Markov Chains, Stochastic Matrix, limiting probabilities		
Unit IV:	**Sampling Theory**	**[6 Hrs]**

Population and Sample, Statistical inference, Sampling with and without replacement, Random samples, Population parameters, Sample statics, Sampling distributions, Sample mean, Sampling distribution of means, Sample variances, Sampling distribution of variances, Case where population variances is unknown, Unbiased estimates and efficient estimates, point estimate and Interval Estimates, Confidence Interval estimates of population parameters, Confidence intervals for variance of a Normal distribution, Maximum likelihood estimates.		
Unit V:	**Tests of Hypothesis and Significance**	**[6 Hrs]**
Statistical hypothesis, Null and Alternate hypothesis, test of hypothesis and significance, Type I and Type II errors, Level of Significance, Tests involving the Normal distribution, One-Tailed and Two-Tailed tests, P value. Special tests of significance for large samples and small samples (F, chi- square, z, t- test), ANOVA		
Unit VI:	**Correlation and Regression**	**[6 Hrs]**
Correlation, Rank correlation, Regression Analysis, Linear and Non-linear Regression, Multiple regression, Curve fitting by method of least squares, fitting of straight lines, polynomials, exponential curves. Non parametric statistic test: Signed rank test, Wilcoxon Rank-sum test		
Text Books:		
	1	A Modern Introduction to Probability and Statistics: Understanding Why and How: F.M. Dekking C. Kraaikamp, H.P. Lopuhaa¨ L.E. Meester (Springer)
	2	Probability And Statistics for Computer Scientists (Second Edition): Michael Baron (CRC Press)
Reference Books:		
	1	Probability & Statistics for Engineers & Scientists: Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers Keying Ye: Prentice Hall
	2	Probability and Statistics for Data Science, Math + R + Data: Norman Matloff (CRC Press, Taylor and Francis group)

List of Assignments: Programming language R

1. Installing R and basic operations and concepts in R
2. A research group collected the yearly data of road accidents with respect to the conditions of following and not following the traffic rules of an accident-prone area. They are interested in calculating the probability of accident given that a person followed the traffic rules. The table of the data is given as follows:

Condition	Follow traffic rule	Does not follow traffic rule
Accident	50	500
No accident	2000	5000

3. In an entrance examination there are twenty multiple choice questions. Each question has four options, and only one of them is correct. Find the probability of having seven or less than seven correct answers if a student attempts to answer every question at random. (Binomial Distribution in R)
4. Let us assume that the test scores an entrance exam fits a normal distribution where the mean test score is 67, and the standard deviation is 13.7. Calculate the percentage of students scoring 80 or more in the exam? (Normal distribution in R)

5 Perform mean, mode, median for the given dataset
6 Variance, standard deviation, quartiles, inter quartiles in R
7 Hypothesis testing in R
8 Linear Regression in R

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ADUA22202: Advance Data Structure

Teaching Scheme
Credits: 4
Lectures: 3 Hrs/week
Practical: 2 Hrs/week

Examination Scheme
Continuous Internal Evaluation (CIE): 20 Marks
In-Semester Examination (ISE): 30 Marks
Skills & Competency Exam (SCE): 20 Marks
End Semester Examination (ESE): 30 Marks
OR: 25 Marks

Prerequisites:

- Fundamentals of data structures

Course Objectives:

- To explain fundamentals of data structures and their applications essential for programming/problem solving.
- To familiarize students with basic data structures and their use in fundamental algorithms
- To understand advanced data structures to solve problems in various domains.
- To enable students to write algorithms for solving problems with the help of fundamental data structures.

Home

Course Outcomes:

After completion of the course, student will be able to

1. Use tree data structure for problem solving and programming.
2. Use graph data structure for problem solving and programming.
3. Apply effective and efficient searching data structure.
4. Understand the data structure required for compiler design.
5. Understand different file organization.

Unit I:	**Trees**	**[6 Hrs]**
Difference between linear and non-liner data structure. Trees and Binary trees- basic terminology, representation using linked organization, Binary tree- properties, converting tree to binary tree, binary tree traversals recursive and non-recursive: depth first and breadth first. Binary Search Tree (BST), BST operations, threaded binary tree- concepts, threading, insertion and deletion of nodes in in-order threaded binary tree, in order traversal of in-order threaded binary tree. **Case Study**- Use of binary tree in expression tree-evaluation and Huffman's coding		
Unit II:	**Graphs**	**[6 Hrs]**
Basic Concepts, Storage representation, Adjacency matrix, adjacency list, adjacency multi list, inverse adjacency list. Traversals-depth first search and strongly connected components, breadth first search and connected components, Minimum spanning Tree, Prims and Kruskal Algorithms,		

Dijkstra's Single source shortest path, Topological ordering. **Case study**- Data structure used in social networking and Google map.		
Unit III:	**Tables**	**[6 Hrs]**
Symbol Table: Notion of Symbol Table, OBST, Huffman's algorithm, Heap data structure, Min and Max Heap, Heap sort implementation, applications of heap Hash tables and scattered tables: Basic concepts, hash function, characteristics of good hash function, different key-to-address transformations techniques		
Unit IV:	**Advanced Trees**	**[6 Hrs]**
AVL Trees, Indexing and Multiway Trees- Indexing, indexing techniques, Types of search tree-Multiway search tree, B-Tree, B+Tree, Trie Tree, Splay Tree, Red-Black Tree.		
Unit V:	**Pattern matching and Tries**	**[6 Hrs]**
Pattern matching algorithms-Brute force, the Boyer –Moore algorithm, the Knuth-Morris-Pratt algorithm, Binary Tries, Compressed Binary Tries, Patricia		
Unit VI:	**File Organization**	**[6 Hrs]**
Sequential file organization-concept and primitive operations, Direct Access File-Concepts and Primitive operations, Indexed sequential file organization-concept, types of indices, structure of index sequential file		

Reference Books:

	1	Data structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI.
	2	Data structures, Algorithms and Applications in C++, S.Sahni, University Press (India) Pvt.Ltd, 2nd edition, Universities Press Orient Longman Pvt. Ltd.
	3	R. Gilberg, B. Forouzan, "Data Structures: A pseudo Code Approach with C++", Cengage Learning, ISBN 9788131503140.

List of Assignments (C/C++):

Sr.No.	Assignment
1	Create Binary tree and perform following operations: a.Insert b.Display c.Depth of a treed. d.Display leaf-nodes e.Create a copy of a tree
2	Construct and expression tree from postfix/prefix expression and perform recursive and non- recursive In-order, pre-order and post-order traversals
3	Implement binary search tree and perform following operations: a.Insert b.Delete c.Mirrorimage d..Display level wise
4	Consider a friends' network on face book social web site. Model it as a graph to represent each node as a user and a link to represent the fried relationship between them. Store data such as date of birth, number of comments for each user. 1.Find who is having maximum friends 2.Find who has post maximum and minimum comments 3.Find users having birthday in this month.
5	Implement Prim's/Kruskal algorithm for any application.
6	For any application find Single source shortest path using Dijkstra's algorithm
7	Implement student database by implementing sequential file organization.
8	Read the marks obtained by students of second year in an online examination of particular subject. Find out maximum and minimum marks obtained in that subject. Use heap data structure. Analyse the algorithm.

9	Hashing Assignment
10	Assignment based on Tries

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Department of Artificial Intelligence and Data Science

ADUA22203: Fundamentals of Computer Networks

Teaching Scheme

Credits: 4

Lectures: 3 Hrs/week

Practical: 2 Hrs/week

Examination Scheme

Continuous Internal Evaluation (CIE): 20 Marks

In-Semester Examination (ISE): 30 Marks

Skills & Competency Exam (SCE): 20 Marks

End Semester Examination (ESE): 30 Marks

OR: 25 Marks

Prerequisites:

- Nil

Course objectives:

- To study the fundamentals of networking
- To understand functionalities of Physical layer
- To understand advanced data structures to solve problems in various domains.
- To study various protocols at Transport and Application Layer

Home

Course Outcomes:

After completion of the course, student will be able to

1 Explore fundamental of network design issues.

2 Recognize the functions of OSI layers & TCP/IP protocol stack.

3 Describe and demonstrate the functionality of Data Link Layer.

4 Apply functionality of Network layer.

5 Describe the functionality of Transport Layer.

6 To Demonstrate concept of application layer protocol.

Unit I:	**Introduction to Computer Network**	**[6 Hrs]**
Network, Network Topologies. **Transmission Media and Switching:** Guided Media: Twisted-Pair, Coaxial and Fiber-Optic Cable Unguided Media: Radio Waves, Microwaves, Infrared IEEE standard and connectors for media. (RJ45, RJ11, BNC, SC/ST etc.) Circuit-switched Networks: Three Phases, Efficiency, Delay, Packet switching: Datagram networks, Virtual circuit networks, Brief introduction of Digital Subscriber Line:ADSL, HDSL, SDSL,VDSL(DMT),Cable modem.		
Unit II:	**Physical Layer:**	
LANs, WANs, and the Internet, PAN, Ad-hoc and WLAN Network, Network Architectures: Client-Server; Peer to Peer; Network as a Platform, Network Topologies, OSI Model, TCP/IP protocol suite; Layer Details, Addressing: Physical &logical Addresses, Port Addresses, Specific Addresses. Connecting devices: Hubs (Passive, active, Intelligent), Switches (Layer-2, Layer-3andManaged), Bridges, Routers, Gateway.		
Unit III:	**Data Link Layer**	**[6 Hrs]**
Data Link Layer Protocols, Media Access Control. Address Resolution Protocol. Types of Errors: Redundancy, Detection Versus Correction, Forward Error Correction Versus Retransmission. Network Layer Protocols, Routing, Routers, Configuring a Cisco Router. IP Addressing: IPv4		

Unit IV:	**Network Layer**	**[6 Hrs]**
Network Addresses, IPv6 Network Addresses, Connectivity Verification. Subnetting IP Networks: Subnetting an IPv4 Network, Addressing Schemes, Address Schemes, Design consideration for IPv6		
Unit V	**Transport Layer**	**[6 Hrs]**
Transport Layer: Transport Layer Protocols, Role of transport layer, Responsibilities of Transport layer, Transport layer reliability. TCP and UDP: TCP communication Process, Reliability and flow control, UDP Communication, applications of TCP and UDP.		
Unit VI	**Application Layer**	**[6 Hrs]**
Application Layer: Application Layer Protocols, Application layer protocols interaction with end-user applications, Presentation and Session layers. Well-Known Application Protocols and Services.		

Text Books:		
	1	Fourauzan B., "Data Communications and Networking", 5th edition, McGraw-Hill Publications
	2	Stallings William.,"Data and Computer Communications",Sixth Edition, Prentice Hall of India .
	3	Andrew S. Tanenbaum, "Computer Networks", Pearson
Reference Books:		
	1	CCNA Basics and Fundamentals-Cisco
	2	CCNA Routing and Switching 200-125 Official Cert. Guide Library
	3	Cisco CCNA Command Guide - An introductory Guide for complete beginners

List of assignments

Sr.No.	Assignment
1	Demonstrate the use of Wireshark tool for network analysis
2	Setup a wired LAN using Layer 2 Switch. It includes preparation of cable, testing of cable using line tester, configuration machine using IP addresses, testing using PING utility and demonstrating the PING packets captured traces using Wireshark Packet Analyzer Tool.
3	Demonstrate the different types of topologies and types of transmission media by using a packet tracer tool.
4	Test with basic network tools. Read the man pages of ifconfig, ping, traceroute, arp, dig and nslookup. Write the solution of the following problems into the report and also paste the screenshots of Terminal into the report. (a) Find the IP address of your machine using 'ifconfig' command. (b) Use 'ping www.iitk.ac.in' command and find out i. the average RTT(round trip time). ii. the %packet loss. iii. size of packet that is sent to www.iitk.ac.in server. iv. size of packet that is received by your machine. (c) Use 'dig www.iitk.ac.in' command and find out i. the ip address of iitk.ac.in. ii. the ip addresses of local DNS servers of your institute (d) Use 'traceroute www.iitk.ac.in' and find out i. number of hops in between your machine and iitk.ac.in server. ii. the ip address of your network gateway of your subnet. (e) Use 'arp -an' command to find out the MAC address of the device that is performing as your network gateway.

5	Write a program for error detection and correction for 7/8 bits ASCII codes using Hamming Codes
6	Write a program to simulate Go back N and Selective Repeat Modes of Sliding Window Protocol in Peer-to-Peer mode
7	Simulation of sliding window protocols
8	To implement socket programming date and time display from client to server using TCP Sockets
9	Write a program using TCP socket for wired network for following a. Say Hello to Each other b File transfer c. Calculator
10	Write a program using UDP Sockets to enable file transfer (Script, Text, Audio and Video one file each) between two machines.
11	Consider the nodes discussed in the previous problem. Now instead of the user typing a line of text to be sent to a specified node, the user will type the name of a local file that is to be sent to the specified node where it will be copied. If the file is large, it may have to be sent as multiple packets. But now introduce some problem in that part of the software that is performing the network layer function in all nodes that are there in a path.(that part which looks up the routing table and forwards packets) - depending on a random number, it either correctly performs the function (say 50% cases), does not forward a particular packet, or stops forwarding all subsequent packets for that "connection". Ensure that in presence of such behaviour the file is correctly transferred.
12	Write a program to demonstrate Sub-netting and find subnet masks
13	Capture packets using Wireshark, write the exact packet capture filter expressions to accomplish the following and save the output in file:
14	Capture all TCP traffic to/from Facebook, during the time when you log in to your Facebook account
15	Capture all HTTP traffic to/from Facebook, when you log in to your Facebook account
16	Write a DISPLAY filter expression to count all TCP packets (captured under item #1) that have the flags SYN, PSH, and RST set. Show the fraction of packets that had each flag set.
17	Count how many TCP packets you received from / sent to Face book, and how many of each were also HTTP packets.

Bansilal Ramnath Agarwal Charitable Trust's
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Department of Artificial Intelligence and Data Science

ADUA22204: Software Engineering

Teaching Scheme
Credits: 4
Lectures: 3 Hrs/week
Practical: 2 Hrs/week

Examination Scheme
Continuous Internal Evaluation (CIE): 20 Marks
In-Semester Examination (ISE): 30 Marks
Skills & Competency Exam (SCE): 20 Marks
End Semester Examination (ESE): 30 Marks
TW: 25 Marks

Prerequisites:

- Basic programming skill

Course Objectives:

- To learn and understand the principles of Software Engineering
- To understand the nature of software complexity in various application domains, disciplined
- Way of software development and software life cycle process models.
- To introduce principles of agile software development, the SCRUM process and agile practices.
- To be acquainted with methods of capturing, specifying, visualizing and analysing software requirements.
- To know methods of capturing, specifying, visualizing and analysing software requirements.
- To understand and apply concepts and principles of software design and architecture.

Course Outcomes:

Upon completion of the course, students will be able to

1. Compare and chose a process model for a software project development
2. Identify unique features of various software applications to write in SRS also to identify domains and classify software applications.
3. Describe principles of agile development, discuss the SCRUM process and distinguish agile process model from other process models.
4. Understand importance of risk management and configuration management & apply risk management strategies and configuration management techniques to various projects.
5. To understand and develop test cases.

Unit I:	**INTRODUCTION TO SOFTWARE ENGINEERING**	**[6 Hrs]**
Nature of Software, The Software Process, Software Myths, A Generic Process Model, Prescriptive Process Models, The Waterfall Model, Incremental Process Models, Evolutionary Process Models, Concurrent Models, Specialized Process Models, Unified Process.		

Unit II:	**AGILE METHODOLOGY**	**[6 Hrs]**
Agile Development: Agile manifesto, agility and cost of change, agility principles, myth of planned development, toolset for the agile process. Extreme Programming: XP values, process, industrial XP, SCRUM - process flow, scrum roles, scrum cycle description, product backlog, sprint planning meeting, sprint backlog, sprint execution, daily scrum meeting, maintaining sprint backlog and burn-down chart, sprint review and retrospective. Agile Practices: test driven development, refactoring, pair programming, continuous integration, exploratory testing versus scripted testing		
Unit III:	**REQUIREMENT ANALYSIS**	**[6 Hrs]**
Requirements Capturing: requirements engineering (elicitation, specification, validation, negotiation, prioritizing requirements (Kano diagram) - real life application case study. Requirements Analysis: basics, scenario-based modelling, UML models: use case diagram and class diagram, data modelling, data and control flow model, behavioural modelling using state diagrams – real life application case study, software Requirement Specification.		
Unit IV:	**RISK MANAGEMENT, CONFIGURATION MANAGEMENT**	**[6 Hrs]**
Project Risk Management: Risk Analysis & Management: Reactive versus Proactive Risk Strategies, Software Risks, Risk Identification, Risk Projection, Risk Refinement, Risk Mitigation, Risks Monitoring and Management, The RMMM plan for case study project. Software Configuration Management: SCM basics, SCM repository, SCM process, SCM tools such as GitHub, CASE – taxonomy, tool-kits, workbenches, environments, components of CASE, categories (upper, lower and integrated CASE tools).		
Unit V:	**TESTING & SOFTWARE QUALITY ASSURANCE**	**[6 Hrs]**
Software Quality, Achieving Software Quality: Software engineering methods, Project Management techniques. Quality control and quality assurance. Software Reliability, SQA Tools, Goals and Metrics, Introduction to Software Testing: Principles of Testing, Testing Life Cycle, Phases of Testing, Types of Testing, Verification & Validation, Defect Management, Defect Life Cycle, Bug Reporting, GUI Testing, Test Management and Automation. Software Process Improvement (SPI): What is SPI, SPI Process, The CMMI, The People CMM, Case study: SPI frameworks.		
Unit VI:	**ADVANCED SOFTWARE ENGINEERING**	**[6 Hrs]**
Maintenance & Reengineering: Software Maintenance, Software Supportability, Reengineering, Business Process Reengineering, Software Reengineering, Reverse Engineering, Restructuring, Forward Engineering. Emerging software engineering trends: technology evolution, process trends, collaborative development, test-driven development, global software development challenges.		

Text Books:

	1	Roger S Pressman "Software Engineering: A Practitioner's Approach "7th Edition McgrawHill ISBN:0073375977
	2	Ian Sommerville "Software Engineering" 9th edition Pearson Education SBN-13: 978-0- 13-703515-1, ISBN-10: 0-13-703515-2, pdf downloadable
	3	Hong Zhu "Software Design Methodology", Elsevier ISBN: 978-81-312-0356-9

Reference Books:

	1	Rajib Mall, "Fundamentals of Software Engineering", Prentice Hall India, ISBN-13: 978-8120348981

	2	Pankaj Jalote, "An Integrated Approach to Software Engineering", Springer, ISBN 13:9788173192715.
	3	Joseph Phillips, IT Project Management –On Track From Start to Finish, Tata Mc Graw-Hill,ISBN13: 978-0-07106727-0, ISBN-10: 0-07-106727-2.
	4	C. Michael Pilato, Ben Collins-Sussman and Brian Fitzpatrick, Version Control with subversion,O'Relly, Shroff publishers, ISBN: 978-81-8404-728-8.

List of Assignments:

Sr.No.	Assignment
1	Write down Customer Problem Statement(CPS)
2	Identify Goals, Requirements (Functional, Non-functional, User Interface) and perform Analysis of the customer problem statement. (Note: Instead of system requirements, you may wish to write User Stories).
3	Derive the use cases based on the requirements from CPS and draw use case diagram.
4	Draw activity diagrams for major use cases.
5	Design and develop User Interface Specification using any UI Tool.
6	Identify analysis level classes and design class diagram.
7	Draw State diagram for the same.
8	List and describe the test cases that will be programmed and used for unit testing of your software.
9	Develop Software Requirement Specification.

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Department of Artificial Intelligence and Data Science

ADUA22205: Operating System

Teaching Scheme

Credits: 3

Lectures: 3 Hrs/week

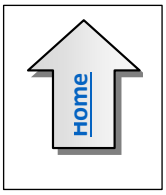
Examination Scheme

Continuous Internal Evaluation (CIE): 20 Marks

In-Semester Examination (ISE): 30 Marks

Skills & Competency Exam (SCE): 20 Marks

End Semester Examination (ESE): 30 Marks



Prerequisites:

- Fundamentals of Computer Organizations and Microprocessors

Course Objectives:

- To provide understanding of the concepts like virtualization, concurrency and persistence in operating systems.
- To study the design and implementation of scheduling and memory management policies in Operating systems.
- To demonstrate the working of concurrency and locking mechanism in operating systems
- To provide insights of I/O management in Operating Systems
- To make them aware of advanced topics e.g., data protection, distributed systems in Operating Systems.
- To teach the case studies of xv6 and Linux OS

Course Outcomes: After completion of the course, student will be able to

Summarize the concepts of virtualization, concurrency and persistence. (Understanding)

1. Implement proper scheduling policies for the OS. (Applying)
2. Implement proper memory management policies for the OS. (Applying)
3. Analyse concurrency and locking mechanism in OS. (Analysing)
4. Describe the I/O management in OS. (Understanding)
5. Compare the working of xv6 and Linux OS. (Analysing & evaluate)

Unit I:	**Introduction to Operating Systems and Process**	**[6 Hrs]**
Introduction to operating systems, Virtualizing the CPU, Virtualization in Memory, Concurrency, Persistence, Design Goals, Some History. **The Process:** Process abstraction, System calls for Process management, Process Creation: A Little More Detail, Process States, Data Structures, Process execution mechanisms Process API, Process Control and Users, Useful Tools.		
Unit II:	**Scheduling**	**[6 Hrs]**
Workload Assumptions, Scheduling Metrics, First In, First Out (FIFO), Shortest Job First(SJF), Shortest Time-to-Completion First(STCF), A new Metric: Response Time, Round Robin, Incorporating I/O, The Multi-Level Feedback Queue, The Priority Boost,		

Attempt, Better Accounting, Multiprocessor Scheduling, Synchronization, Cache Affinity, Single-Queue Scheduling Multi-Queue Scheduling, Linux Multiprocessor Schedulers.

Unit III:	**Address Spaces**	**[6 Hrs]**

Early Systems, Multiprogramming and Time Sharing, The Address Space, Memory API**:**Types of Memory, The malloc() Call, The free() Call, Common Errors, Underlying OS Support, Segmentation, Fine-grained vs. Coarse-grained Segmentation, Free-Space Management**,** Paging, A Memory Trace, Faster Translations (TLBs), TLB Basic Algorithm, Example: Accessing An Array, Who Handles The TLB Miss, TLB Issue: Context Switches, Replacement Policy, Hybrid Approach: Paging and Segments, Beyond Physical Memory: Mechanisms**,** Swap Space, The Present Bit, The Page Fault, What If Memory Is Full?, Page Fault Control Flow, When Replacements Really Occur, The Linux Virtual Memory System.

Unit IV:	**Concurrency**	**[6 Hrs]**

Shared Data, Uncontrolled Scheduling, The Wish For Atomicity, Waiting For Another, **Thread API :** Why Use Threads?, Thread Creation, Thread Completion **Locks :** The Basic Idea, Pthread Locks, Building A Lock, Evaluating Locks, Controlling Interrupts, Failed Attempt: Just Using Loads/Stores, Building Working Spin Locks with Test-And-Set, Compare-And-Swap, Load-Linked and Store-Conditional, Fetch-And-Add, Different OS, Different Support, **Semaphores:** A Definition, Binary Semaphores (Locks) Semaphores For Ordering, The Producer/Consumer (Bounded Buffer) Problem, Reader-Writer Locks The Dining Philosophers, How To Implement Semaphores, Common Concurrency Problems.

Unit V:	**I/O Devices**	**[6 Hrs]**

System Architecture, A Canonical Device, The Canonical Protocol, Lowering CPU Overhead with Interrupts, More Efficient Data Movement With DMA, Methods of Device Interaction, Fitting into the OS: The Device Driver, Case Study: A Simple IDE Disk Driver, Hard Disk Drives, Redundant Arrays of Inexpensive Disks (RAIDs), Files and Directories, *Locality and The Fast File System*, File System Implementation, Flash-based SSDs.

Unit VI:	**Advanced topics in OS**	**[6 Hrs]**

Data Integrity and Protection: Disk Failure Modes, Handling Latent Sector Error, Detecting Corruption: The Checksum, Using Checksums, Performance evaluation of computer systems, load testing, Little 'slaw, Distributed Systems, Sun's Network File System (NFS), The Andrew File System (AFS), Case Studies of: The **xv6** operating system, The **Linux** Operating Systems.

Text Books:

	1	Remzi H.Arpaci-Dusseau and Andrea C. Arpaci-Dusseau "OperatingSystems: Three Easy Pieces", Arpaci-Dusseau Books, March, 2015
	2	Stallings William.,"Operating Systems", FourthEdition, Prentice Hall of India, 2001

Reference Books:

	1	Silbers chatz, A,Galvin, P.B, and Gagne,G., "Operating System Principles",Eight Edition, John Wiley & Sons, 2008.
	2	Bach Maurice J. "The Design of the UNIX Operating System", Second Edition Prentice Hall of India, 2001

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Department of Artificial Intelligence and Data Science

ADUA22206: Web Technology

Teaching Scheme
Credits: 3
Lectures: 1 Hr/week
Practical: 4 Hrs/week

Examination Scheme
Continuous Internal Evaluation (CIE): -
In-Semester Examination (ISE): -
Skills & Competency Exam (SCE): -
End Semester Examination (ESE): -
TW:50 Marks

Prerequisites:

- Fundamentals of programming

Course Objectives:

- To evaluate problems and analyse data using current technologies
- To learn how to employ Integrated Development Environment (IDE) for implementing and testing of software solution
- To acquire contemporary skills to make the students employable in computer engineering domain

Course Outcomes: After completion of the course, student will be able to

1. Utilize current technologies in a wide variety of business and organizational contexts using modern tools
2. Identify Integrated Development Environment (IDE) for implementing and testing of software solution.
3. Apply best practices for building applications.
4. Make use of contemporary skills to make them employable

Unit I:	**HTML/HTML5 And CSS/CSS3**	**[2 Hrs]**
Applying Designs to WireFrames with HTML5 and CSS3, Build Your Own HTML5 Video Player, Building Responsive Websites with HTML5 and CSS3, HTML5 and CSS3 Site Design HTML5 Mobile Game Development by Example – Educational Game, HTML5 Mobile Game Development by Example -Veggies vs Zombies, Make HTML5 Games with No Coding Required, Understanding HTML5 Input Types, Website Wireframing with HTML5 and CSS3		
Unit II:	**Javascript Development**	**[2 Hrs]**
Fundamentals Of JavaScript, JavaScript for Beginning Web Developers, JavaScript for Absolute Beginners, Fundamentals of jQuery, Fundamentals of Ajax Development, Create a node.js Real Time Chat Application, Advanced JavaScript		
Unit III:	**Node.Js**	**[2 Hrs]**
• Introduction and Foundation, Node Projects, Working with shrink-wrap to lock the node modules versions, Working with asynchronous programming, Building a HTTP Server with Node.JS using HTTP APIs, File System, Buffers, Streams, and Events, Multi-Processing in NodeJS, ExpressJS, Express JS with MongoDB and Sqlite, io, The Front-end, and A Chat App, Introduction to Task Managers with unit testing		

Unit IV:	**Angular**	**[2 Hrs]**
What is a SPA? What is Angular?, Preparing for TypeScript, Angular-4 new features, Building with A4 Components, Bootstrap Scaffolding, Angular 4 Binding and Events, Dependency Injection and services, Directives, Pipes, Forms, HTTP, Promises, and Observables, Testing		
Unit V:	**MongoDB**	**[2 Hrs]**
Introduction to NoSQL databases, MongoDB A Database for the Modern Web, CRUD Operations in MongoDB, Indexing and Aggregation, Replication and Sharding, Developing Java and Node JS Application with MongoDB, Administration of MongoDB Cluster Operations		
Unit VI:	**React.js**	**[2 Hrs]**
Welcome to Starting with React, React Components, React State and Props, React Event Handling, Routing in React React flux, Styling React		

Text Books:		
	1	Achyut Godbole & Atul Kahate, "Web Technologies: TCP/IP to Internet Application Architectures", McGraw Hill Education publications
	2	Ralph Moseley & M. T. Savaliya, "Developing Web Applications", Wiley publications.
Reference Books:		
	1	Adam Bretz & Colin J Ihrig, "Full Stack Javascript Development with MEAN", SPD
	2	Giulio Zambon, " Beginning JSP, JSF and Tomcat", Apress Publication
	3	Jeremy McPeak& Paul Wilton," Beginning JavaScript", Wrox Publication, ISBN-13: 978- 0470525937
	4	Robin Nixon, "Learning PHP, Mysql and Javascript with JQuery, CSS & HTML5", O'REILLY, ISBN: 13:978-93-5213-015-3
	5	Black Book, "Struts 2", Dreamtech Press, ISBN 13, : 9788177228700
	6	Black Book, " JDBC 4.2, Servlet 3.1 & JSP 2.3", Dreamtech Press, ISBN-13: 978-8177228700
	7	Sandeep Panda, "Angular JS: Novice To Ninja", SPD, First Edition 2014, ISBN-13: 978- 0992279455
	8	Brad Dayley, Brendan Dayley, Caleb Dayley, "Node.js, MongoDB and Angular Web Development", 2nd Edition, Addison-Wesley
	9	Ethan Brown, "Web Dvelopment with Node and Express", O'reilly, ISBN – 978-1-491-94930-6
	10	Jennifer Niederst Robbins, "Learning Web design", O'reilly, 4th Edition

List of Assignments:

Sr. No.	Assignment
1	Using HTML5/CSS3 develop informative and responsive web page for Library Management System.
2	Create a user registration form for Library Management System in HTML and write a JavaScript Program to apply form validation and to get user registration details.
3	Manipulate and design the user registration form using CSS3 selector with jQuery

	functions.
4	Create a CRUD application using AJAX.
5	Create HTTP server and create required API's for user registration of Library Management System form using Node.js
6	Develop dashboard for Library Management System having functionalities of Login, Book Issue and Return using Angular.
7	Develop an application for a Library Management System using Node.js and MongoDB.
8	Develop dashboard for Library Management System having functionalities of Login, Book Issue and Return using react JS.

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ES22207AD: Soft Skills

Teaching Scheme
Credits: 2
Lectures: 1 Hr/week
Practical: 2 Hrs/week

Examination Scheme
Continuous Internal Evaluation (CIE): -
In-Semester Examination (ISE): -
Skills & Competency Exam (SCE): -
End Semester Examination (ESE): -
TW:50 Marks

Home

Prerequisites:

- Basic knowledge in communication and a good understanding of English

Course Objectives:

- To encourage the all-round development of students by focusing on soft skills.
- To make the engineering students aware of the importance, the role and the content of soft skills through instruction, knowledge acquisition, demonstration and practice.
- To develop and nurture the soft skills of the students through individual and group activities.
- To expose students to right attitudinal and behavioral aspects and to build the same through activities

Course Outcomes: After completion of the course, student will be able to

1. Effectively communicate through verbal/oral communication and improve the listening skills
2. Write precise briefs or reports and technical documents.
3. Actively participate in group discussion / meetings / interviews and prepare & deliver presentations.
4. Become more effective individual through goal/target setting, self-motivation and Practicing creative thinking.
5. Function effectively in multi-disciplinary and heterogeneous teams through the knowledge of team work, Inter-personal relationships, conflict management and leadership quality.

Unit I:	**Self-Awareness &self-Development**	**[6 Hrs]**

a) **Self-Assessment**, Self-Appraisal, SWOT, Goal setting - Personal & career - Self-Assessment, Self-Awareness, Perceptions and Attitudes, Positive Attitude, Values and Belief Systems, Self-Esteem, Self-appraisal, Personal Goal setting,
b) **Career Planning**, Personal success factors, Handling failure, Depression and Habit, relating SWOT analysis & goal setting, prioritization.
c) **Other Skills**

- **Time management**- The Time management matrix, apply the Pareto Principle (80/20 Rule) to time management issues, to priorities using decision matrices, to beat the most common time wasters, how to plan ahead, how to handle interruptions, to maximize your

personal effectiveness, how to say "no" to time wasters, develop your own individualized plan of action

- **Stress management**- understanding the stress & its impact, techniques of handling stress
- **Problem solving skill**, Confidence building Problem solving skill, Confidence building

Corporate / Business Etiquettes - Corporate grooming & dressing, Email & telephone etiquettes, etiquettes in social & office setting Understand the importance of professional behaviour at the work place, Understand and Implement etiquettes in workplace, presenting oneself with finesse and making others comfortable in a business setting. Importance of first impression, Grooming, Wardrobe, Body language, Meeting etiquettes (targeted at young professionals who are just entering business environment) Introduction to Ethics in engineering and ethical reasoning, rights and responsibilities..

Unit II:	**Communication Skill**	**[6 Hrs]**

a) **Importance of communication**, types, barriers of communication, effective communication
b) **Speaking Skills** – Public Speaking, Presentation skills, Group discussion- Importance of speaking effectively, speech process, message, audience, speech style, feedback, conversation and oral skills, fluency and self expression, body language phonetics and spoken English, speaking techniques, word stress, correct stress patterns, voice quality, correct tone, types of tones, positive image projection techniques.
c) **Listening Skills:** Law of nature- you have 2 ears and 1 tongue so listen twice and speak once is the best policy, Empathic listening, Avoid selective listening
d) **Group Discussion** - characteristics, subject knowledge, oral and leadership skills, team management, strategies and individual contribution and consistency.
e) **Presentation skills** - planning, preparation, organization, delivery.
f) **Written Skills** – Formal & Informal letter writing, Report writing, Resume writing - Sentence structure, sentence coherence, emphasis. Paragraph writing. letter writing skills - form and structure, style and tone. Inquiry letters, Instruction letters, complaint letters,
Routine business letters, Sales Letters etc.

References:

	1	Soft skills Training – A workbook to develop skills for employment by Fredrick H. Wentz 2. 3. 4
	2	Personality Development and Soft skills, Oxford University Press by Barun K. Mitra
	3	The Time Trap: the Classic book on Time Management by R. Alec Mackenzie
	4	Interview skills that win the job: Simple Techniques for answering all the tough questions , Allen & Unwin

List of Assignments:

Sr.No.	**Assignment**
1	SWOT analysis
2	Personal & Career Goal setting – Short term & Long term
3	Presentation Skill
4	Letter/Application writing
5	Report writing
6	Listening skills
7	Group discussion
8	Resume writing
9	Public Speaking

10	Stress management
11	Team Activity- Use of Language laboratory