Shri Vile Parle Kelavani Mandal's

Dwarkadas J. Sanghvi College of Engineering

(Autonomous College Affiliated to the University of Mumbai)

Scheme and detailed syllabus
of
Second Year B.Tech (DJS22)
in
Artificial Intelligence and Machine Learning
(Semester III) AY 23-24

Shri Vile Parle Kelavani Mandal's
DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING
(Autonomous College Affiliated to the University of Mumbai)
NAAC Accredited with 'A' Grade (CGPA : 3.18)

Proposed Scheme for Second Year Undergraduate Program in Artificial Intelligence and Machine Learning : Semester III (Autonomous)
(Academic Year 2023-2024)

Sr	Course Code	Course	Teaching Scheme(hrs)				Continuous Assessment (A) (marks)			Semester End Assessment (B) (marks)					Aggregate (A+B)	Total Credits
			Th	P	T	Credits	Th	T/W	Total CA (A)	Th	O	P	O &P	Total SEA (B)		
1	DJS22AMC301	Engineering Mathematics-III	3	–	–	3	35	–	35	65	–	–	–	65	100	4
	DJS22AMT301	Engineering Mathematics-III Tutorial	–	–	1	1	–	25	25	–	–	–	–	–	25	
2	DJS22AMC302	Data Structures	3	–	–	3	35	–	35	65	–	–	–	65	100	4
	DJS22AML302	Data Structures Laboratory	–	2	–	1	–	25	25	–	–	–	25	25	50	
3	DJS22AMC303	Database Management Systems	3	–	–	3	35	–	35	65	–	–	–	65	100	4
	DJS22AML303	Database Management Systems Laboratory	–	2	–	1	–	25	25	–	–	–	25	25	50	
5	DJS22AMC304	Operating Systems	3	–	–	3	35	–	35	65	–	–	–	65	100	4
	DJS22AML304	Operating Systems Laboratory	–	2	–	1	–	25	25	–	–	–	25	25	50	
6	DJS22AML305	Programming Laboratory-I (Python Programming)	–	4	–	2	–	25	25	–	–	–	25	25	50	2
7	DJS22IHC1	Universal Human Values	2	–	–	2	35	–	35	65	–	–	–	65	100	3
	DJS22IHT1	Universal Human Values Tutorial	–	–	1	1	–	25	25	–	–	–	–	–	25	
8	DJS22ILLA1	Innovative Product Development I (A)	–	2	–	–	–	–	–	–	–	–	–	–	–	–
		Total	14	12	2	21	175	150	325	325	0	0	100	425	750	21

Th	Theory	T/W	Termwork
P	Practical	O	Oral
T	Tutorial		

Prepared by

Checked by

Head of the Department

Vice Principal

Principal

Program: Artificial Intelligence & Machine Learning S.Y B.Tech Semester: III

Course: Engineering Mathematics-III (DJS22AMC301)

Course: Engineering Mathematics-III Tutorial (DJS22AMT301)

Pre-requisite: -- Knowledge of

1. Solving a simultaneous linear equation using concept of matrices.
2. Calculus.

Objectives:

- Understanding basic concepts of linear algebra.
- Apply the concepts of vector spaces, linear transformations, matrices and inner product spaces in engineering.
- To understand the concept of Optimization and enhance the problem solving skills and Optimization techniques.

Outcomes: On completion of the course, learner will be able to:

- Learn the basic notation of vector spaces and subspaces.
- Apply the concept of inner product spaces to the engineering problems.
- Apply the concept of vector spaces using linear transformations which is used in computer graphics and inner product spaces.
- Apply the concepts of eigenvalue and eigenvectors and diagonalization in linear systems.
- Apply the concept of Linear & Non-Linear Programming Problem to the engineering problems.

Detailed Syllabus: Engineering Mathematics - III (DJ22AMC301)		
Unit	**Description**	**Duration**
1	**Vector Space:** **Preview:** Linear combinations of vectors, Linearly dependent and independent vectors. Definition of vector space over R, Subspaces. Basis and Dimension.	4
2	**Inner Product Spaces:** Dot product in R, Definition of general inner product on a vector space over R. Norm of a vector in an inner product space. Cauchy-Schwarz inequality. Orthogonal sets and orthonormal sets in an inner product space. Orthogonal and orthonormal bases. Gram-Schmidt orthogonalization process simple examples in R^2, R^3.	5

3	**Linear Transformations:** Definition and properties. Kernel and image of a linear transformation, Rank-Nullity Theorem. Invertible Linear Transformation, Relation between matrices and Linear Transformations, Change of bases.	8
4	**Matrices:** Eigen values, Eigen vectors and their properties. Cayley-Hamilton theorem (without proof) and its application. Similar matrices, diagonalization of matrix. Functions of square matrix. Singular value decomposition.	8
5	**Calculus**: Gradient, directional derivatives, Jacobian, Hessian, convex sets, convex functions, and its properties.	4
6	**Optimization:** **Unconstrained optimization techniques:** Newton's method, Quasi Newton method. **Constrained optimization techniques:** gradient descent, stochastic gradient descent, Penalty function method, Lagrange multiplier method, Karush–Kuhn–Tucker method, Simplex method, Penalty and Duality, Dual simplex method, Downhill simplex method.	10
	Total	39

Engineering Mathematics - III Tutorial (DJ22AMT301)	
Tut.	**Suggested Tutorials**
1	Vector Space.
2	Inner Product Space.
3	Gram-Schmidt orthogonalization process.
4	Linear Transformation.
5	Eigen Value and Eigen Vector and Similarity of Matrices.
6	Cayley-Hamilton Theorem, Functions of square matrix.
7	Singular value decomposition.
8	Calculus
9	Unconstrained Optimization Techniques.
10	Constrained Optimization Techniques.

Minimum eight tutorials from the above suggested list or any other tutorial based on syllabus will be included, which would help the learner to apply the concept learnt.

Books Recommended:

Text books:

- Linear Algebra, Jin Ho Kwak and Sungpyo Hong, Second edition Springer (2004).
- Introductory Linear Algebra- An applied first course, Bernard Kolman and David, R. Hill, 9th Edition Pearson Education, 2011.
- Operation Research by Hira & Gupta,S Chand.
- Advanced Engineering Mathematics, Erwin Kreyszig, 10th Edition, John Wiley India, 2015.

Reference Books:

- Elementary Linear Algebra, Stephen Andrilli and David Hecker, 5th Edition, Academic Press(2016)
- Applied Abstract Algebra, Rudolf Lidl, Guter Pilz, 2 nd Edition, Springer 2004.
- Contemporary linear algebra, Howard Anton, Robert C Busby, Wiley 2003.
- Introduction to Linear Algebra, Gilbert Strang, 5 th Edition, Cengage Learning (2015).
- Operations Research by S.D. Sharma Kedar Nath, Ram Nath & Co. Meerat.
- Engineering optimization (Theory and Practice) by Singiresu S.Rao, New Age International publication.
- Higher Engineering Mathematics, B. S. Grewal, 43rd Edition, Khanna Publishers, India, 2015.

Evaluation Scheme: Semester End Examination (A):

Theory:

1. Question paper will be based on the entire syllabus summing up to 65 marks.
2. Total duration allotted for writing the paper is 2 hrs.

Continuous Assessment (B):

Theory:

1. One term test of 20 marks and one term test/ presentation / assignment / course project / group discussion / any other of 15 marks will be conducted during the semester
2. Total duration allotted for writing the paper is 1 hr.

Tutorial: (Term work)

Term work shall consist of a minimum of 8 Tutorials.

The distribution of marks for term work shall be as follows:

i. Performance in each tutorial: 25 marks

The allocation of marks for tutorials shall adhere to the pre-established rubric parameters. The final certification and acceptance of term work will be subject to satisfactory performance of Tutorial and upon fulfilling minimum passing criteria in the term work.

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Program: Artificial Intelligence & Machine Learning **S.Y B.Tech** **Semester: III**

Course: Data Structures (DJS22AMC302)

Course: Data Structures Laboratory (DJS22AML302)

Pre-requisite: Knowledge of C – Programming

Course Objectives: The objective of the course is to introduce and familiarize students with linear and non-linear data structures, their use in fundamental algorithms and design & implementation of these data structures. To introduce students to the basics of algorithms and time complexity. To familiarize students with various sorting and searching techniques, and their performance comparison.

Course Outcomes: On successful completion of this course, student should be able to:

1. Understand the concept of time complexity for algorithms.
2. Assimilate the concept of various linear and non-linear data structures.
3. Solve the problem using appropriate data structure.
4. Implement appropriate searching and sorting algorithms for a given problem.

Data Structures and Algorithms (DJS22AMC302)		
Unit	**Description**	**Duration**
1	**Basics of Algorithms:** Algorithms, Characteristics of an Algorithm, Time and Space Complexities, Order of Growth functions, Preliminary Asymptotic Notations. **Data Structures:** Introduction, need of Data Structures, Types of Data Structures, Abstract Data Types (ADT)	04
2	**Linear Data Structures – LIST:** List as an ADT, Array-based implementation, Linked List implementation, singly linked lists, circularly linked lists, doubly-linked lists, All operations (Insertion, Deletion, Merge, Traversal, etc.) and their analysis, Applications of linked lists - (Polynomial Addition).	06
3	**Linear Data Structure – STACK:** Stack as an ADT, Operations, Array and Linked List representation of Stack, Applications – Reversing data, Conversion of Infix to prefix and postfix expression, Evaluation of postfix and prefix expressions, balanced parenthesis, etc.	04
4	**Linear Data Structure – QUEUE:** Queue as an ADT, Operations, Implementation of Linear Queue, Circular and Priority Queue using arrays and Linked List, DEQueue,Applications – Queue Simulation.	04
5	**Non-Linear Data Structure – TREES:** Tree Terminologies, Tree as an ADT, Binary Tree - Operations, Tree Traversals, Binary Search Tree (BST) - Operations, Expression Trees **Height Balanced Tree**: Creation of AVL Tree, **Heap-** Operations on heap **Applications** - Huffman coding	10

6	**Non-Linear Data Structure – GRAPHS:** Graph Terminologies, Types of Graphs, Representation of Graph using arrays and Linked List, Breadth-First Search (BFS), Depth–First Search (DFS), **Applications of Graphs** - Topological sorting.	03
7	**Searching-** Linear Search, Binary Search and Fibonacci search. **Sorting:** Bubble Sort, Selection Sort, Heap Sort, Insertion Sort, Radix Sort, Merge Sort, Quick Sort. Analysis of Searching and Sorting Techniques. **Hashing:** Hash Functions, Overflow handling, Collision & Collision Resolution Techniques, Linear hashing, Hashing with chaining, Separate Chaining, Open Addressing, Rehashing and Extendible hashing.	08
	Total	39

Data Structures and Algorithms Laboratory (DJS22AML302)	
Exp.	**Suggested experiments**
1	Implementation of Linked List using menu driven approach.
2	Implementation of different operations on linked list –copy, concatenate, split, reverse, count no.of nodes etc.
3	Implementation of polynomials operations (addition, subtraction) using Linked List.
4	Implementation of stack using menu driven approach.
5	Implementation of Infix to Prefix. Transformation and its evaluation program.
6	Implementation of prefix and postfix evaluation using menu driven approach.
7	Implementation of parenthesis checker using stack.
8	Implementation of Linear queue using menu driven approach.
9	Implementation of circular queue using menu driven approach.
10	Implementation of double ended queue menu driven program.
11	Implementation of Priority queue program using array and Linked list.
12	Implementation of Binary Tree using menu driven approach.
13	Implementation of Binary Tree Traversal.
14	Implementation of BST using following operations – create, delete, display.
15	Implementation of various operations on tree like – copying tree, mirroring a tree, counting the number of nodes in the tree, counting only leaf nodes in the tree.
16	Implementation of Graph traversal using menu driven program (DFS & BSF).

17	Implementations of Selection sort, Radix sort using menu driven.
18	Implementation of Heap & Heap Sort using menu driven program.
19	Implementation of Advanced Bubble Sort and Insertion Sort using menu driven Program.
20	Implementation of searching methods (Index Sequential, Fibonacci search, Binary Search) usingmenu driven program.
21	Implementation of hashing functions with different collision resolution techniques.

Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

A minimum of 10 experiments from the above suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Books Recommended:

Textbooks:

1. R. F. Gilberg and B. A. Forouzan, "Data Structures – A Pseudocode Approach with C", 2nd Edition, Cengage Learning, 2005.
2. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, "Fundamentals of Data Structures in C", 2nd Edition, W. H. Freeman and Company 2008.

Reference Books:

1. Mark A. Weiss, "Data Structures and Algorithm Analysis in C", 4th Edition, Pearson, 2014.
2. M. T. Goodritch, R. Tamassia, D. Mount, "Data Structures and Algorithms in C++", Wiley, Second Edition, 2011.
3. Kruse, Leung, Tondo, "Data Structures and Program Design in C", 2nd Edition, Pearson Education, 2013.
4. Tenenbaum, Langsam, Augenstein, "Data Structures using C", Pearson, Second edition 2015.
5. J. P. Tremblay and P. G. Sorenson, "Introduction to Data Structures and its Applications", 2nd Edition, McGraw- Hill, 1984.
6. Aho, Hopcroft, Ullman, "Data Structures and Algorithms", Addison-Wesley, 2010.
7. Reema Thareja, "Data Structures using C", Oxford, 2017.
8. Seymour Lipschutz, Data Structures, Schaum's Outline Series, 1st Edition, Tata McGraw-Hill, 2014.

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper will be based on the entire syllabus summing up to 65 marks.

2. Total duration allotted for writing the paper is 2 hrs.

Laboratory:

1. Oral & Practical examination will be based on the entire syllabus including the practical performed during laboratory sessions.

Continuous Assessment (B):

Theory:

1. One term test of 20 marks and one term test/ presentation / assignment / course project / group discussion / any other of 15 marks will be conducted during the semester
2. Total duration allotted for writing the paper is 1 hr.

Laboratory: (Term work)

Term work shall consist of a minimum of 10 experiments and a minimum of 2 assignments.The distribution of marks for term work shall be as follows:

i. Laboratory work (Performance of Experiments): 15 marks

ii. Journal Documentation (Write-up and Assignments): 10 marks

The allocation of marks for laboratory work and tutorials shall adhere to the pre-established rubric parameters.

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

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Program: Artificial Intelligence & Machine Learning **S.Y B.Tech** **Semester: III**

Course: Database Management Systems (DJS22AMC303)

Course: Database Management Systems Laboratory (DJS22AML303)

Prerequisite: Computer Basics

Course Objectives: The course intends to introduce the students to the management of database systems, with an emphasis on how to design, organize, maintain and retrieve information efficiently andeffectively from a database.

Course outcomes: On successful completion of this course, learner will be able to:

1. Design an optimized database.
2. Construct SQL queries to perform operations on the database.
3. Demonstrate appropriate transaction management and recovery techniques for a given problem.
4. Apply indexing mechanisms for efficient retrieval of information from database.

Detailed Syllabus: Database Management Systems (DJS22AMC303)		
Unit	**Description**	**Duration**
1	**Introduction Database Concepts:** Introduction, Characteristics of databases, File system v/s Database system, Users of Database system, Schema and Instance, Data Independence, DBMS system architecture, Database Administrator	03
2	**Relational Data Model:** **Entity–Relationship Model:** The Entity-Relationship (ER) Model: Entity types: Weak and strong entity sets, Entity sets, Types of Attributes, Keys, Relationship constraints: Cardinality and Participation, Extended Entity-Relationship (EER) Model: Generalization, Specialization and Aggregation **Relational Model:** Introduction to the Relational Model, relational schema and concept of keys, Mapping the ER and EER Model to the Relational Model, Introduction to Object-Relational Databases, ORDBMS Vs Relational Databases **Relational Algebra** – Unary and Set operations, Relational Algebra Queries.	09
3	**Structured Query Language (SQL):** Overview of SQL, Data Definition Commands, Data Manipulation commands, Integrity constraints - key constraints, Domain Constraints, Referential integrity, check constraints, Data Control commands, Transaction Control Commands, Set and String operations, aggregate function - group by, having, Views in SQL, joins, Nested and complex queries, Triggers, Security and authorization in SQL	09

4	**Relational–Database Design:** Pitfalls in Relational-Database designs, Concept of normalization, Function Dependencies, Normal Forms- 1NF, 2NF, 3NF, BCNF	05
5	**Transaction Management and Recovery:** Transaction Concept, ACID properties, Transaction States, Implementation of atomicity and durability, Concurrent Executions, Serializability, Concurrency Control Protocols: Lock-based, Timestamp based, Validation Based, Deadlock Handling, Recovery System: Failure classification, Log based recovery, Shadow Paging, ARIES recovery algorithm.	09
6	**Indexing Mechanism:** Hashing techniques, Types of Indexes: Single Level Ordered Indexes, Multilevel Indexes, Overview of B-Trees and B+ Trees.	04
	Total	**39**

List of Laboratory Experiments:

Database Management Systems Laboratory (DJS22AML303)	
Exp.	**Suggested experiments**
1	To draw an ER diagram for a problem statement.
2	Map the ER/EER to relational schema.
3	To implement DDL and DML commands with integrity constraints.
4	To access & modify Data using basic SQL.
5	To implement Joins and Views.
6	To implement Subqueries.
7	To implement triggers.
8	Examine the consistency of database using concurrency control technique (Locks)
9	To simulate ARIES recovery algorithm.
10	To implement B-trees/B+ trees.

Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

Books Recommended:

Text books:

1. Korth, Silberchatz, Sudarshan, —Database System Concepts, 7th Edition, McGraw – Hill, 2019.
2. Elmasri and Navathe, —Fundamentals of Database Systems, 7th Edition, Pearson education, 2016.
3. Peter Rob and Carlos Coronel, —Database Systems Design, Implementation and Management, Thomson Learning, 5th Revised Edition, 2002.
4. G. K. Gupta —Database Management Systems, 3rd Edition, McGraw – Hill, 2018.

Reference Books:

1. Dr. P.S. Deshpande, SQL and PL/SQL for Oracle 10g, Black Book, Dreamtech Press, 2012

2. Sharaman Shah, —Oracle for Professional, Shroff Publishers & Distributers Private Limited, 1st edition, 2008
3. Raghu Ramakrishnan and Johannes Gehrke, — Database Management Systems, 3rd Edition, McGraw – Hill, 2014.
4. Patrick Dalton, "Microsoft SQL Server Black Book", Coriolis Group,U.S., 11th ed. edition (1 July 1997)
5. Lynn Beighley, "Head First SQL", O'Reilly Media, 1st edition (28 August 2007)

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus, summing up to 65 marks.
2. The total duration allotted for writing the paper is 2 hrs.

Laboratory:

1. Oral and practical examinations will be based on the entire syllabus including the practical performed during laboratory sessions.

Continuous Assessment (B):

Theory:

1. One term test of 20 marks and one term test/ presentation / assignment / course project / group discussion / any other of 15 marks will be conducted during the semester
2. Total duration allotted for writing the paper is 1 hr.

Laboratory: (Term work)

Term Work shall consist of at least 10 experiments based on the above list.

The distribution of marks for term work shall be as follows:

i. Laboratory work (Performance of Experiments, Write-up): 15 Marks
ii. Assignment and Mini Project: 10 marks

The allocation of marks for laboratory work and tutorials shall adhere to the pre-established rubric parameters.

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

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Program: Artificial Intelligence & Machine Learning **S.Y B.Tech** **Semester: III**

Course: Operating Systems (DJS22AMC304)

Course: Operating Systems Laboratory (DJS22AML304)

Prerequisite:

1. Programming Language C.
2. Basics of Hardware, i.e., ALU, RAM, ROM, HDD, etc

Course Objectives: The objective of this course is to familiarize students with the functionality of an Operating System, its basic components & interaction among them. The course will also expose students to analyze and evaluate different policies for scheduling, deadlocks, memory management, synchronization, file management & I/O and implement these policies using a suitable programming language.

Outcomes: On successful completion of this course, student should be able to:

1. Understand the role of Operating System in terms of process, memory, file and I/O management.
2. Apply appropriate process scheduling, memory mapping and disk scheduling methods.
3. Identify the need of concurrency and apply the appropriate method to solve the concurrency or deadlock problem.
4. Apply and analyze different techniques of file and I/O management.

Operating Systems (DJS22AMC305)		
Unit	**Description**	**Duration**
1	**Introduction to Operating System:** Operating System Objectives, basic functions and services, Evolution of operating system, Operating System structures (monolithic, microkernel), Types of Operating Systems: Batch, multiprogramming. Multitasking, time sharing, parallel, distributed & real-time O.S., Linux OS, Mobile OS, System calls.	8
2	**Process Management:** Concept of a Process, Process States, Process Description, Process Control Block, Operations on Processes. **Threads**: Definition and Types, Concept of Multithreading, **Scheduling:** Types of Scheduling: Preemptive and, Non-preemptive, Scheduling algorithms and their performance evaluation: FCFS, SJF, SRTF, Priority based, Round Robin.	8

3	**Process Synchronization** **Concurrency:** Principles of Concurrency, Inter-Process Communication, Process/Thread Synchronization. **Mutual Exclusion:** Requirements, Hardware and Software Support, Semaphores and Mutex, Monitors, Classical synchronization problems: Producer and Consumer problem, Readers/Writers Problem.	8
4	**Deadlock:** Principles of deadlock, Conditions for deadlock, Resource Allocation Graph, Deadlock Prevention, Deadlock Avoidance: Banker's Algorithmfor Single & Multiple Resources, Deadlock Detection and Recovery. Dining Philosophers Problem.	7
5	**Memory Management** Memory Management Requirements, Memory Partitioning: Fixed Partitioning, Dynamic Partitioning, Memory Allocation Strategies: Best-Fit, First Fit, WorstFit, Next Fit, Relocation, Paging, Segmentation. Virtual Memory: Demand Paging, Structure of Page Tables, Page Replacement Strategies: FIFO, Optimal, LRU, LFU, Thrashing.	4
6	**File System and I/O Management File Management:** Overview, File Organization and Access, Secondary Storage Management: File Allocation Methods **Input /Output Management** I/O Management and Disk Scheduling: I/O Devices, I/O Buffering, Disk Scheduling algorithm: FCFS, SSTF, SCAN, CSCAN, LOOK, C-LOOK. RAID	4
	Total	**39**

	Title of Experiments Operating Systems Laboratory (DJS22AML304)
1	Explore the internal commands of linux and Write shell scripts to do the following: Display top 10 processes in descending order Display processes with highest memory usage. Display current logged in user and logname. Display current shell, home directory, operating system type, current path setting, current working directory. Display OS version, release number, kernel version. Illustrate the use of sort, grep, awk, etc.
2	System calls for file manipulation.
3	CPU scheduling algorithms like FCFS, SJF, Round Robin etc.
4	There is a service counter which has a limited waiting queue outside it. It works as follows: • The counter remains open till the waiting queue is not empty • If the queue becomes empty, the outlet doors will be closed (service personnel sleep) • Whenever a customer arrives at the closed outlet, he/she needs to wake the person at thecounter with a wake-up call • If the queue is already full, the new customer simply leaves Implement the above-described problem using semaphores or mutexes along with threads. Also show how it works, if there are 2 service personnel, and a single queue. Try to simulate all possible events that can take place, in the above scenario.
5	Implement Banker's Algorithm for deadlock avoidance
6	Implement Placement algorithms (Best, First, Worst fit)
7	Implement various page replacement policies (LRU, FIFO, Optimal)
8	Implement File allocation techniques (Sequential, Indexed, Linked)
9	Implement disk scheduling algorithm FCFS, SSTF, SCAN, CSCAN etc.
10	Using the CPU-OS simulator analyze and synthesize the following: a. Process Scheduling algorithms. b. Thread creation and synchronization. c. Deadlock prevention and avoidance.
11	Building a scheduler in XV6
12	Building own file system.

Minimum eight experiments from the above suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Books Recommended:

Text Books

1. Abraham Silberschatz, Greg Gagne, Peter Baer Galvin, "Operating System Concepts", 8thEdition, Wiley,2018.
2. Tanenbaum, "Modern Operating System", 4th Edition, Pearson Education, 2014.
3. William Stallings, Operating System: Internals and Design Principles, Prentice Hall, 8th Edition, 2014, ISBN-10: 0133805913 • ISBN-13: 9780133805918.
4. Andrew Tannenbaum, Operating System Design and Implementation, Pearson, 3rd Edition.
5. Randal. K. Michael, "Mastering Shell Scripting", 2nd Edition, Wiley Publication, 2008.

Reference Books:

1. Maurice J. Bach, "Design of UNIX Operating System", PHI
2. Achyut Godbole and Atul Kahate, Operating Systems, Mc Graw Hill Education, 3rd Edition
3. The Linux Kernel Book, Remy Card, Eric Dumas, Frank Mevel, Wiley Publications.
4. Phillip A. Laplante, Seppo J. Ovaska, "Real Time Systems Design and Analysis", 4th Edition, Wiley-IEEE Press,Dec 2011.
5. Naresh Chauhan, "Principles of Operating Systems", 1st Edition, Oxford University Press, 2014.

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Program: Artificial Intelligence & Machine Learning **S.Y B.Tech** **Semester: III**

Course: Programming Laboratory – I (Python Programming) (DJS22AML305)

Pre-requisite: --

- C Programming

Objectives:

1. To learn the basic and OOP concepts of Python.
2. To study various advanced python concepts like inheritance, exception handling, modules etc.
3. Learn to develop GUI based standalone and web application.

Outcomes: On completion of the course, the learner will be able to:

1. Understand basic and object-oriented concepts, data structure implementation in python.
2. Apply file, directory handling and text processing concepts in python.
3. Apply database connectivity, client-server communication using python.
4. Develop python-based application (web/Desktop) using Django web framework/Tkinter.

Programming Laboratory – I (Python Programming) (DJS22AML305)		
Unit	**Description**	**Duration**
1	**Python basics** Data types in python, Operators in python, Input and Output, Control statement, Arrays in python, String and Character in python, Functions, Listand Tuples, Dictionaries, limitations of Python	4
2	**Control Statements and Functions:** If statement, if-elif-else, Repetition using while loop, for loop, defining a Function, Checking & Setting Your Parameters, Default arguments, Variable length arguments, Defining and calling functions within a function, Layers of Functions, Lambda and Filter, Zip (), Map (), Reduce () function, recursion, Function Decorators.	4
3	**Introduction to OOP:** Creating a Class, Self-Variables, Constructors, Types of Methods, Constructors in Inheritance, Polymorphism, the super Method, Method Resolution Order (MRO), Operator Overloading, Method Overloading & Overriding, Interfaces in Python Exceptions Handling: Exceptions, Exception Handling, Types of Exceptions, Except Block, assert Statement, User Defined Exceptions.	6

4	**Advanced Python** Building Modules, Packages: Python Collections Module, Opening and Reading Files and Folders (Python OS Module, Python Datetime Module, Python Math and Random Modules, Text Processing, Regular expression in python	3
5	**Python Integration Primer Graphical User interface using Tkinter** : Form designing, Networking in Python: Client Server socket programming Python database connectivity: Data Definition Language (DDL), and Data Manipulation Language (DML)	3
6	**Python advance Modules Numpy:** Working with Numpy, Constructing Numpy arrays, Printing arrays, Arithmetic Operations on matrix's, numpy zeros() Matplotlib: Matplotlib- Plot different charts, Pandas: Data Processing, Pandas-Data structure, Pandas-Series data, Data Frames, Introduction to data processing using pandas	6
	Total	**26**

Programming Laboratory – I (Python Programming) (DJS22AML305)	
Exp.	**Suggested experiments**
1	Write python programs to understand Expressions, Variables, Quotes, Basic Math operations.
2	Write python programs to demonstrate applications of different decision-making statements.
3	Write a Python program to implement Basic String Operations & String Methods.
4	Write a Python program to implement functions of List, Tuples, and Dictionaries.
5	Write a Python program to implement Arrays (1D, 2D) applications.
6	Write a Python program to implement Functions and Recursion.
7	Write a Python program to implement Programs based on Lambda, Map, and Reduce Functions.
8	Write a Python program to implement program to implement concept of Function decorators.
9	Write python programs to implement Classes & objects, Constructors
10	Write python programs to implement Inheritance & Polymorphism.

11	Write python programs to implement Exception handling.
12	Write python programs to understand different File handling operations with exception handling.
13	Write python programs to implement database connectivity and DDL and DML commands in Python using SQLite.
14	Write python programs to understand GUI designing (Programs based on GUI designing using Tkinter.
15	Implement different Machine learning packages like numpy, pandas and matplotlib.

Minimum eight experiments from the above suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Books Recommended:

Text books:

1. Dr. R. Nageswara Rao, "Core Python Programming", 3rd Edition, Dreamtech Press, 2018.

2. Mark Lutz, "Learning Python", 5th Edition, Oreilly Publication, 2013.

3. E Balagurusamy, "Introduction to computing and problem-solving using Python", McGraw Hill Education, 2018

Reference Books:

1. Zed A. Shaw, "Learn Python the Hard Way", 3rd Edition, Addison–Wesley Publication, 2014.

2. Laura Cassell, Alan Gauld, "Python Projects", Wrox Publication, 2015.

Evaluation Scheme:

Semester End Examination (A):

Laboratory:

1. Oral and practical examinations will be based on the entire syllabus including the practical performed during laboratory sessions.

Continuous Assessment (B):

Laboratory: (Term work)

Term Work shall consist of at least 10 experiments based on the above list.

The distribution of marks for term work shall be as follows:

i. Laboratory work (Performance of Experiments, Write-up): 20 Marks

ii. Assignment 10 marks

iii. Attendance: 5 marks

iv. Mini Project: 15 marks

The allocation of marks for laboratory work and tutorials shall adhere to the pre-established rubric parameters.

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

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Program: Artificial Intelligence & Machine Learning **S.Y. B.Tech** **Semester: III**

Course: Universal Human Values (DJS22IHC1)

Course: Universal Human Values Tutorial (DJS22IHT1)

Prerequisite:

Objectives:

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

Outcomes: On completion of the course, learner will be able to:

1. Become more aware of themselves, and their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind. They would have better critical ability.
2. Become sensitive to their commitment towards what they have understood (human values, human relationship, and human society).
3. Apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	Introduction: Need, Basic Guidelines, Content and Process for Value Education Purpose and motivation for the course. Self-Exploration–whatis 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 fulfilmentof 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.	**05**

2	Understanding Harmony in the Human Being - Harmony in Myself! 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 instrumentof 'I' (I am being the doer, seer and enjoyer). Understanding the characteristics and activities of 'I' and harmony in 'I'. Understanding theharmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail. Programs to ensure Sanyam and Health.	**06**
3	Understanding Harmony in the Family and Society: Harmony in Human-Human Relationship. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment 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.	**06**
4	Understanding Harmony in the Nature and Existence: Whole existence as Coexistence Understanding the harmony in the Nature 19. Interconnectedness and mutual fulfilment among the four orders of naturerecyclability and self-regulation in nature. Understanding Existence as Co-existence of mutually interacting units in all pervasive space. Holistic perception of harmony at all levels of existence.	**05**
5	Understanding Harmony in the Nature and Existence: Whole existence as Coexistence Understanding the harmony in the Nature 19. Interconnectedness and mutual fulfilment among the four orders of naturerecyclability and self-regulation in nature. Understanding Existence as Co-existence of mutually interacting units in all pervasive space. Holistic perception of harmony at all levels of existence.	06

Books Recommended:

Textbooks:

1. Human Values and Professional Ethics by R 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 - PanditSunderlal

9. Rediscovering India - by Dharampal

10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi

11.India Wins Freedom - Maulana Abdul Kalam Azad

12. Vivekananda - Romain Rolland (English)

13. Gandhi - Romain Rolland (English)

Evaluation:

Semester End Examination

(A): Theory:

1) Question paper will be based on the entire syllabus summing up to 75 marks.

2) Total duration allotted for writing the paper is 3 hrs. Continuous Assessment

(B): Theory:

1) Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.

2) Total duration allotted for writing each of the paper is 1 hr.

3) Average of the marks scored in both the two tests will be considered for final grading.

Continuous Assessment (C):

Tutorials: (Term work)

1. Term work shall consist of minimum 4activities based on activities suggested.

2. Term work shall carry total 25 marks based on the performance in the tutorials.

The tutorials could be conducted as per the following topics: -

Activity No 1	Practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony, and coexistence) rather than as arbitrariness in choice based on liking-disliking.

Activity No 2	Practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease.
Activity No 3	Practice sessions to reflect on relationships in family, hostel and institute
	as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives.
Activity No 4	Practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.
Activity No 5	Practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions e.g. To discuss the conduct as an engineer or scientist etc.

The final certification and acceptance of term work will be subject to satisfactory performance of activities and upon fulfilling minimum passing criteria in the term work.

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Program: Artificial Intelligence & Machine Learning **S.Y B.Tech** **Semester: III**

Course: Innovative Product Development-I (DJS22ILLA1)

Pre-requisite: --

Objectives:

1. To acquaint the students with the process of identifying the need (considering a societal requirement) and ensuring that a solution is found out to address the same by designing and developing an innovative product.
2. To familiarize the students with the process of designing and developing a product, while they workas part of a team.
3. To acquaint the students with the process of applying basic engineering fundamentals, so as to attempt at the design and development of a successful value added product.
4. To inculcate the basic concepts of entrepreneurship and the process of self-learning and research required to conceptualize and create a successful product.

Outcomes: On completion of the course, the learner will be able to:

1. Identify the requirement for a product based on societal/research needs.
2. Apply knowledge and skills required to solve a societal need by conceptualising a product, especially while working in a team.
3. Use standard norms of engineering concepts/practices in the design and development of aninnovative product.
4. Draw proper inferences through theoretical/ experimental/simulations and analyse the impact ofthe proposed method of design and development of the product.
5. Develop interpersonal skills, while working as a member of the team or as the leader.
6. Demonstrate capabilities of self-learning as part of the team, leading to life-long learning, whichcould eventually prepare themselves to be successful entrepreneurs.
7. Demonstrate product/project management principles during the design and development workand also excel in written (Technical paper preparation) as well as oral communication

Guidelines for the proposed product design and development:

1. Students shall form a team of 3 to 4 students (max allowed: 5-6 in extraordinary cases, subject to the approval of the department review committee and the Head of the department).
2. Students should carry out a survey and identify the need, which shall be converted into conceptualization of a product, in consultation with the faculty supervisor/head of department/internal committee of faculty members.
3. Students in the team shall understand the effective need for product development and accordinglyselect the best possible design in consultation with the faculty supervisor.
4. Students shall convert the best design solution into a working model, using various components drawn from their domain as well as related interdisciplinary areas.
5. Faculty supervisor may provide inputs to students during the entire span of the activity, spread over2 semesters, wherein the main focus shall be on self-learning.
6. A record in the form of an activity log-book is to be prepared by each team, wherein the team canrecord weekly progress of work. The guide/supervisor should verify the recorded notes/commentsand approve the same on a weekly basis.
7. The design solution is to be validated with proper justification and the report is to be compiled in astandard format and submitted to the department. Efforts are to be made by the students to try andpublish a technical paper, either in the institute journal, "Techno Focus: Journal for Budding Engineers" or at a suitable publication, approved by the department research committee/ Head of the department.
8. The focus should be on self-learning, capability to design and innovate new products as well as on developing the ability to address societal problems. Advancement of entrepreneurial capabilities and quality development of the students through the year long course should ensure that the designand development of a product of appropriate level and quality is carried out, spread over two semesters, ie during the semesters III and IV.

Guidelines for Assessment of the work:

1. The review/ progress monitoring committee shall be constituted by the Head of the Department. The progress of design and development of the product is to be evaluated on a continuous basis, holding a minimum of two reviews in each semester.
2. In the continuous assessment, focus shall also be on each individual student's contribution to the team activity, their understanding and involvement as well as responses to the questions being raised at all points in time.
3. Distribution of marks individually for the both reviews as well as for the first review during the subsequent semester shall be as given below:
4. Marks awarded by the supervisor based on log-book: 20
5. Marks awarded by review committee: 20
6. Quality of the write-up: 10

Review/progress monitoring committee may consider the following points during the assessment.

1. The entire design proposal shall be ready, including components/system selection as well as the cost analysis.
2. Two reviews will be conducted based on the presentation given by the student's team.
3. First shall be for finalization of the product selected.
4. Second shall be on finalization of the proposed design of the product.

The overall work done by the team shall be assessed based on the following criteria:

1. Quality of survey/ need identification of the product.
2. Clarity of Problem definition (design and development) based on need.
3. Innovativeness in the proposed design.
4. Feasibility of the proposed design and selection of the best solution.
5. Cost effectiveness of the product.
6. Societal impact of the product.
7. Functioning of the working model as per stated requirements.
8. Effective use of standard engineering norms.
9. Contribution of each individual as a member or the team leader.
10. Clarity on the write-up and the technical paper prepared.

Guidelines for Assessment of Semester Reviews:

1. The write-up should be prepared as per the guidelines given by the department.
2. The design and the development of the product shall be assessed through a presentation and demonstration of the working model by the student team to a panel of Internal and External Examiners, preferably from industry or any research organisations having an experience of more than five years, approved by the Head of the Institution

Prepared By Dr. Nitesh Rathod | Checked by | Head of the Department | Principal