Shri Vile Parle Kelavani Mandal's

Dwarkadas J. Sanghvi College of Engineering

(Autonomous College Affiliated to the University of Mumbai)

Scheme and detailed syllabus

Second Year B.Tech

in

Artificial Intelligence and Machine Learning

(Semester III)

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

(Academic Year 2022-2023)

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	DJ19AMC301	Engineering Mathematics-III	4	--	--	4	25	--	25	75	--	--	--	75	100	5
	DJ19AMT301	Engineering Mathematics-III Tutorial	--	--	1	1	--	25	25	--	--	--	--	--	25	
2	DJ19AMC302	Data Structures and Algorithms	3	--	--	3	25	--	25	75	--	--	--	75	100	4
	DJ19AML302	Data Structures and Algorithms Laboratory	--	2	--	1	--	25	25	--	--	--	25	25	50	
3	DJ19AMC303	Database Management Systems	3	--	--	3	25	--	25	75	--	--	--	75	100	4
	DJ19AML303	Database Management Systems Laboratory	--	2	--	1	--	25	25	--	--	--	25	25	50	
4	DJ19AMC304	Discrete Structures	3	--	--	3	25	--	25	75	--	--	--	75	100	4
	DJ19AMT304	Discrete Structures Tutorial	--	--	1	1	--	25	25	--	--	--	--	--	25	
5	DJ19AMC305	Operating Systems	3	--	--	3	25	--	25	75	--	--	--	75	100	4
	DJ19AML305	Operating Systems Laboratory	--	2	--	1	--	25	25	--	--	--	25	25	50	
6	DJ19AML306	Programming Laboratory-I (Python Programmin	--	2	--	1	--	25	25	--	--	--	25	25	50	1
7	DJ19A2	Innovative Product Development-I (A)	--	2	--	--	--	--	--	--	--	--	--	--	--	--
8	DJ19A3	Constitution of India (A)	1	--	--	--	--	--	--	--	--	--	--	--	--	--
		Total	17	10	2	22	125	150	275	375	0	0	100	475	750	22

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

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

Course: Engineering Mathematics - III (DJ19AMC301)

Course: Engineering Mathematics - III Tutorial (DJ19AMT301)

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 Fourier Series, its complex form and enhance the problem solving skill 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 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.
- Expand the periodic function by using Fourier series and complex form of Fourier series.
- Apply the concept of Linear & Non-Linear Programming Problem to the engineering problems.

Detailed Syllabus: Engineering Mathematics - III (DJ19AMC301)		
Unit	**Description**	**Duration**
1	**Vector Space and Inner Product Spaces:** Definition of vector space over $\mathbb{R}$, Subspaces. Linear combinations, Linearly dependent and independent vectors, Basis, Dimension. **Inner Product Spaces:** Dot product in $\mathbb{R}^n$, Definition of general inner product on a vector space over $\mathbb{R}$. Norm of a vector in an inner product space. Cauchy-Schwarz inequality.	**12**

	Orthogonal sets and orthonormal sets in an inner product space. Orthogonal and orthonormal bases. Gram-Schmidt orthogonalization process simple examples in $\mathbb{R}^2$, $\mathbb{R}^3$	
2	**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.	**10**
3	**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**
4	**Calculus**: Gradient, directional derivatives, Jacobian, Hessian, convex sets, convex functions, and its properties.	**4**
5	**Optimization:** Unconstrained and Constrained 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**
6	**Fourier series:** Dirichlet's conditions, Fourier series of periodic functions with period 2π and 2L and Fourier series for even and odd functions. Half range sine and cosine Fourier series, Parseval's identities (without proof). Complex form of Fourier series, Orthogonal and Orthonormal set of functions.	**8**
	Total Lecture Hours	**52**

Engineering Mathematics - III Tutorial (DJ19AMT301)	
Tut.	**Suggested Tutorials**
1	Vector Space.
2	Inner Product Space.
3	Linear Transformation.
4	Eigen Value and Eigen Vector and Similarity of Matrices.

5	Cayley-Hamilton Theorem, Functions of square matrix.
6	Singular value decomposition.
7	Calculus
8	Unconstrained Optimization Techniques.
9	Constrained Optimization Techniques.
10	Fourier Series.
11	Half-Range Fourier Series
12	Complex Form of Fourier Series.

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.

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

Course: Data Structures and Algorithms (DJ19AMC302)

Course: Data Structures and Algorithms Laboratory (DJ19AML302)

Pre-requisite:

Course Objectives:

1.To understand the basic concepts of data structures and algorithms

2.To differentiate linear and non-linear data structures and the operations upon them.

3.Ability to perform sorting and searching in a given set of data items.

4.To comprehend the necessity of time complexity in algorithms

Course Outcome:

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

1. Understanding the fundamental analysis and time complexity for a given problem.
2. Articulate linear and non-linear data structures and operations permitted on them.
3. Applying a suitable algorithm for searching and sorting.
4. Understanding the importance of hashing.
5. Application of appropriate data structures to find solutions to practical problems.

Data Structures and Algorithms (DJ19AMC302)		
Unit	**Description**	**Duration**
1	**Introduction to Algorithms and Analysis** Overview and importance of algorithms and data structures. Fundamentals of algorithm analysis, Space and time complexity of an algorithm, Types of asymptotic notations and orders of growth, Algorithm efficiency–best case, worst case, average case, Analysis of non-recursive and recursive algorithms, Asymptotic analysis for recurrence relation –Recursive Tree Method, Master Theorem.	3
2	**Linear Data Structures** Stack– Stack Operations, Applications of stack: Expression Evaluation-Conversion of Infix to postfix and prefix expression,	10

	Queue- Queue Operations, Types of Queues: Circular Queue, Double Ended Queue, Applications –Priority Queue using Arrays List-Singly linked lists, Doubly linked lists, Circular linked lists, Operations on Singly Linked List, Stack and Queue implementation using Linked Lists	
3	**Non-Linear Data Structures** Tree-Terminology, Binary Tree– Terminology and Properties, Tree Traversals, Expression Trees– Binary Search Trees– operations in BST– insertion, deletion, finding min and max, Applications –Dictionary Graph–basic definition and Terminology– Representation of Graph–Graph Traversal: Breadth First Search (BFS), Depth First Search (DFS) –Minimum Spanning Tree: Prim's, Kruskal's- Single Source Shortest Path: Dijkstra 's Algorithm, Bellman Ford, Multistage graph, All Pair Shortest Path, Travelling salesperson problem, Least-cost answer node-15-puzzle problem	14
4	**Heaps and Balanced Binary Search Trees** Heaps- Heapsort, Applications- Priority Queue using Heaps, AVL trees– Terminology- basic operations (rotation, insertion, and deletion), B Tree	4
5	**Searching and Sorting** Searching- Linear Search and binary search, Fibonacci Search, Analysis Applications- Finding square root of 'n '- Longest Common Prefix Sorting–Insertion sort- Selection sort, Quicksort, Merge sort, Analysis	6
6	**Hashing** Hash functions, open hashing-separate chaining, closed hashing -linear probing, quadratic probing, double hashing, random probing, rehashing, extendible hashing, Applications–Dictionary-Telephone directory	2
	Total	**39**

Data Structures and Algorithms Laboratory (DJ19AML302)	
Exp.	**Suggested experiments**
1	Implementation of stack to find the just next greater number which can be formed using digits of given number.
2	Implementation of multi-stack in one array.

3	Using a stack find the length of the longest prefix of each of the given parenthesis's expressions that is valid, or 0 if there's no such prefix.
4	Implementation of Infix to Postfix. Transformation and its evaluation program.
5	Implementation of Infix to Prefix. Transformation and its evaluation program.
6	Using a queue find if the love mobiles can be brought into the order that the organizers want them to be.
7	Using the concepts of stack and queue sort the elements of a given array.
8	Implementation of circular queue menu driven program.
9	Implementation of double ended queue menu driven program.
10	Implementation of queue menu driven program.
11	Implementation of Priority queue program using array.
12	Implementation of Linked Lists menu driven program.
13	Implementation of different operations on linked list –copy, concatenate, split, reverse, count no. of nodes etc.
14	Implementation of polynomials operations (addition, subtraction) using Linked List.
15	Implementation of Linked Lists menu driven program (stack and queue).
16	Implement merging of even and odd positioned nodes into new linked list.
17	Implementation of construction of expression tree using postfix expression.
18	Implementation of BST program.
19	Write a program to verify whether the given 3 traversals are of the same tree or not.
20	Implementation of various operations on trees like – copying tree, mirroring trees, counting the number of nodes in the tree, counting only leaf nodes in the tree.
21	Implementation of Graph menu driven program (DFS & BFS).
23	Implementations of Heap & Heap Sort menu driven program.
24	Implementation of Advanced Bubble Sort, Insertion Sort and Selection Sort menu driven Program.
26	Implementation of hashing functions with different collision resolution techniques

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.
1. Narasimha Karumanchi, "Data Structures and Algorithms Made Easy", Career Monk Publications, 2nd Edition, 2011
2. Thomas H. Cormen, C.E. Leiserson, R L. Rivest and C. Stein, Introduction to Algorithms, Third edition, MIT Press, 2009.

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, 2004.
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, 2004.
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, 2010.

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

Course: Database Management Systems (DJ19AMC303)

Course: Database Management Systems Laboratory (DJ19AML303)

Pre-requisite: Computer Fundamentals

Objectives:

1. To learn effective database designing, development, maintenance, and efficient information retrieval.

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

- Demonstrate ER modeling and Relational mapping to construct a database for given real-life problems and apply normalization to it.
- Construct SQL queries to perform operations on the database.
- Examine transaction processing and recovery mechanisms on a database.
- To understand various advanced databases and design an application using them.

Database Management Systems (DJ19AMC303)		
Unit	**Description**	**Duration**
1	**Introduction Database Concepts:** Introduction, Characteristics of databases, File system v/s Database system, Users of Database system, Data Independence, DBMS system architecture, Database Administrator	3
2	**Entity–Relationship Data 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 **Relational Algebra:** unary and set operations, Relational Algebra Queries.	6
3	**Structured Query Language (SQL)** Overview of SQL, Data Definition Commands, Data Manipulation commands, Data Control commands, Transaction Control Commands.	8

	Integrity constraints - key constraints, Domain Constraints, Referential integrity, check constraints, set and string operations, aggregate function, group by clause, having Clause Views in SQL, joins, Nested and complex queries, Triggers Introduction to PL/SQL - Procedures and Functions	
4	**Relational–Database Design** Pitfalls in Relational-Database designs, Concept of normalization, Functional Dependencies, First Normal Form, 2NF, 3NF, BCNF	6
5	**Transactions Management and Concurrency** Transaction concept, Transaction states, ACID properties, Concurrent Executions, Serializability – Conflict and View, Concurrency Control: Lock-based, Timestamp-based protocols, Deadlock Handling **Recovery System:** Introduction to Recovery system, Log based Recovery, Shadow paging	6
6	**Advance Databases:** Why NoSQL? SQL vs NoSQL, Types of NoSQL databases: Key-value store, Document database, Column-oriented database, Graph database **MongoDB:** Key features, MongoDB Query Language: Data type, Create database - Collections and Documents, Updating and Querying database, Querying through Indexes, **Rocksdb:** Overview, Opening/closing, Read/Write, Rocksdb Block Based Table Format, Log File Format, Benefits and Limitations. **Introduction:** Time Series Databases and Spatial and Temporal Databases	10
	Total	**39**

Database Management Systems Laboratory (DJ19AML303)	
Exp.	**Suggested experiments**
1	Identify the case study and detail statement of problem. Design an Entity-Relationship (ER) /Extended Entity-Relationship (EER) Model.
2	Mapping ER/EER to Relational schema model.
3	Create and populate database using Data Definition Language (DDL) and DML Commands (Apply various Integrity Constraints)
4	Perform Simple queries, string manipulation operations.
5	Nested queries and Complex queries.
6	Perform Join operations.
7	Views and Triggers.

8	Procedures (PL/SQL)
9	Examine the consistency of database using concurrency control technique (Locks)
10	Perform CRUD operations in MongoDB.
11	Mini project using any given/recent database. (RDBMS, Rocksdb, Cassandra, MongoDB, Redis, Neo4J, InfluxDB/KairosDB, PostgreSQL etc.)

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. 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.
5. Xun (Brian) Wu, Sudarshan Kadambi, Devram Kandhare, Aaron Ploetz ― Seven NoSQL Databases in a Week, Packt Publishing Limited, 2018

Reference Books:

1. Dr. P.S. Deshpande, SQL and PL/SQL for Oracle 10g, Black Book, Dreamtech Press, 2012
2. Gillenson, Paulraj Ponniah, ―Introduction to Database Management‖, Wiley Publication, 1st , 2007
3. Sharaman Shah, ―Oracle for Professional, Shroff Publishers & Distributers Private Limited, 1st edition, 2008
4. Raghu Ramakrishnan and Johannes Gehrke, ― Database Management Systems, 3rd Edition, McGraw – Hill, 2014.
5. Lynn Beighley, "Head First SQL", O'Reilly Media, 2007.
6. Gaurav Vaish ―Getting started with NoSQL, Packt Publishing Limited, 2013.
7. https://www.mongodb.com/

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

Course: Discrete Structures (DJ19AMC304)

Course: Discrete Structures Tutorial (DJ19AMT304)

Pre-requisite: --

Objectives:

1. To cultivate clear thinking and creative problem solving.
2. To thoroughly train in the construction and understanding of mathematical proofs. Exercise common mathematical arguments and proof strategies.
3. To thoroughly prepare for the mathematical aspects of other Computer Engineering courses.

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

1. Verify the correctness of an argument using propositional and predicate logic and truth tables.
2. Understand relations, Diagraph and lattice, functions.
3. Apply principles and concepts of graph theory in practical situations.
4. Demonstrate the ability to solve problems using counting techniques and combinatorics in the context of discrete probability.
5. Understand the different Algebraic structures and demonstrate use of groups and codes in Encoding and Decoding.

Discrete Structures (DJ19AMC304)		
Unit	**Description**	**Duration**
1	**Sets and Logic:** **Set Theory:** Introduction to Set Theory, Venn diagrams, Operations on Sets, Power sets, Laws of set theory, Cartesian Product, Partitions of sets, The Principle of Inclusion and Exclusion, Introduction to Fuzzy sets, Properties of Fuzzy sets, Fuzzy set operations, Fuzzy Cartesian product **Mathematical Logic:** Propositions and Logical operations, Truth tables, Laws of Logic, Logical Equivalence, Normal Forms, Predicates, Fallacies, Quantifiers, Mathematical induction Introduction to First Order Predicate Logic, Inference Rules: Universal and Existential instantiation, Universal and Existential generalization, Universal Modus Ponens, Universal Modus Tollens, Multiple Quantifiers, Negation of more than one variable	12

2	**Relations, Posets and Lattices** **Introduction:** Relations and their properties, Paths and Digraphs, Types of binary relations, Operations on relations, Equivalence relations: Closures, Warshall's algorithm, Composition of relations. Introduction to Fuzzy Relations. Properties of Fuzzy relations, Fuzzy composition of relations: Max-min composition and Max-product composition **Posets and Lattices:** Partial ordered sets, Hasse diagram, Lattice and its types, Boolean algebra.	10
3	**Functions** Types of functions - Injective, Surjective and Bijective, Composition of functions, Identity and Inverse function, Pigeon hole principle	4
4	**Graphs and Trees** **Introduction to Graph theory:** Definitions, Paths, circuits, connectivity, Types of Graphs, Eulerian and Hamiltonian Graph, Sub Graphs, Planar Graphs, Chromatic number, Graph coloring, Isomorphism of graphs, **Introduction to Trees:** Trees, rooted trees, path length in rooted trees, Prefix codes and optimal prefix codes	4
5	**Generating Function and Recurrence relation**: Recurrence Relation: linear recurrence relation with constant coefficients, Homogeneous and non-homogeneous recurrence relation, Generating function	4
6	**Number Theory and Algebra** **Groups:** Binary operations, Group, Semigroup, Monoid, Sub-group, Cyclic group, Homomorphism and Isomorphism of groups, Cosets. **Coding theory:** Group codes, Parity-check and Generator matrix, Hamming codes, Maximum likelihood technique **Rings and Fields:** Definition, Sub rings, Integral domain, Field, Integer modulo n, Ring homomorphism.	5
	Total	**39**

Minimum eight tutorials based on syllabus will be conducted. Mini project relevant to the subject may be included, which would help the learner to apply the concept learnt.

Tutorials: Discrete Structures Tutorial (DJ19AMT304)

1	Problems on Set Theory
2	Problems on Mathematical Logic
3	Problems on Relations
4	Problems on Posets and Lattices
5	Problems on Functions
6	Problems on Graph theory
7	Problems on Trees
8	Problems on Generating Function
9	Problems on Recurrence relation
10	Problems on Groups
11	Problems on Coding theory
12	Problems on Rings and Field

Books Recommended:

Text books:

1. Bernad Kolman, Robert Busby, Sharon Cutler Ross, Nadeem-ur-Rehman, "Discrete Mathematical Structures", Pearson Education 2015.
2. C.L. Liu, D P Mohapatra, "Elements of Discrete Mathematics", 4E, McGraw-Hill 2012.
3. Douglas B West.," Introduction to Graph Theory" 2nd Edition, Eastern Economy Edition published by PHI Learning Pvt. Ltd.
4. Ralph Grimaldi, "Discrete and Combinatorial Mathematics" 5th ed, Pearson Education
5. S.N. Sivanandam, S. N. Deepa, "Principles of Soft Computing", 2nd Edition, 2011 Wiley India Pvt. Ltd

Reference Books:

Y N Singh, "Discrete Mathematical Structures", Wiley-India.

1. J. L. Mott, A. Kandel, T. P. Baker, "Discrete Mathematics for Computer Scientists and Mathematicians", Prentice Hall of India.
2. J. P. Trembley, R. Manohar "Discrete Mathematical Structures with Applications to Computer Science", McGraw-Hill.
3. Seymour Lipschutz, Marc Lipson, "Discrete Mathematics", Schaum's Outline Series McGraw Hill Education.

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

Course: Operating Systems (DJ19AMC305)

Course: Operating Systems Laboratory (DJ19AML305)

Pre-requisite: Basic Mathematics

Course Objectives: The objective of this course is

to understand the structure, functions and characteristics of computer system and operating systems

Outcomes: Students will be able to

1. Understand role of Operating System in terms of process, memory, file and I/O management.

2. Apply appropriate process scheduling and Thread management.

3. Identify the need of concurrency and apply appropriate method to solve the concurrency or deadlock problem.

4. Apply and analyse different techniques of memory, file and I/O management.

Operating Systems (DJ19AMC305)		
Unit	**Description**	**Duration**
1	**Operating System Architecture:** Operating System Objectives and Functions and services, System calls, Evolution and types of operating system : Batch, multiprogramming. Multitasking, time sharing, parallel, distributed & real -time O.S. Operating System structures, System Calls, Case Study on Linux OS, OS Design Considerations for Multiprocessor architectures	8
2	**Process Management:** Process Concept, Process states, Process control block Threads: Definition and Types, Concept of Multithreading, Multi core processors and threads. Scheduling: Uni-processor Scheduling: Types of scheduling: Pre-emptive, Non pre-emptive, Scheduling algorithms: FCFS, SJF, RR, Priority.	8
3	**Memory Management:** Memory Management Requirements, Memory partitioning: Fixed and Variable Partitioning, Memory Allocation: Allocation Strategies (First Fit, Best Fit, and Worst Fit), Fragmentation, Swapping,	8

	Virtual Memory: Demand Paging, Structure of Page Tables, Page Replacement Strategies: FIFO, Optimal, LRU, LFU, Thrashing.	
4	**Concurrency control Concurrency:** Principles of Concurrency, Inter-Process Communication, Process/Thread Synchronization, Mutual Exclusion: Requirements, S/W approaches, H/W Support, Semaphores, Monitors, Classical Problems of Synchronization: Readers-Writers and Producer Consumer problems and solutions, Case Study	7
5	**Deadlock:** Principles of deadlock, Conditions and Resource Allocation Graphs, Deadlock Prevention, Deadlock Avoidance, Banker's Algorithm for Single & Multiple Resources, Deadlock Detection, Dining Philosopher problem.	4
6	**File and I/O management:** File Overview, File Organization and access 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**

Operating Systems Laboratory (DJ19AML305)	
Exp.	**Suggested experiments**
1	Explore the basic commands of Linux. pwd, cd, ls, cp, mv, mkdir, rmdir, rm, touch, grep, sudo, chmod, chown Display current shell, home directory, current path setting, current working directory. Illustrate the use of sort, grep, awk, etc.
2	Implement file system calls in linux.
3	Implement CPU scheduling algorithms like FCFS, SJF, Round Robin etc
4	Implement Multithreading.
5	Implement Best Fit, First Fit and Worst Fit Memory allocation policy
6	Implement various page replacement policies
7	Implement Producer -Consumer problem with Semaphore
8	Implement order scheduling in supply chain using Banker's Algorithm
9	Implement Disk Scheduling Algorithm
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.

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. William Stallings, Operating System: Internals and Design Principles, Prentice Hall, 8th Edition, 2014, ISBN-10: 0133805913 • ISBN-13: 9780133805918.

2. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, John Wiley & Sons , Inc., 9th Edition, 2016, ISBN 978-81-265-5427-0

3. Andrew Tannenbaum, Operating System Design and Implementation, Pearson, 3rd Edition.

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.

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

Course: Programming Laboratory – I (Python Programming) (DJ19AML306)

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:

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

Programming Laboratory – I (Python Programming) (DJ19AML306)		
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, List and 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.	6
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	6

	Exceptions Handling: Exceptions, Exception Handling, Types of Exceptions, Except Block, assert Statement, User Defined Exceptions	
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)(DJ19AML306)	
Exp.	**Suggested experiments**
1	Write python programs to understand Expressions, Variables, Quotes, Basic Math operations.
2	Write a Python program to implement Basic String Operations & String Methods.
3	Write a Python program to implement functions of List, Tuples, and Dictionaries.
4	Write a Python program to implement Arrays (1D, 2D) applications.
5	Write python programs to demonstrate applications of different decision-making statements.
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.

Prepared by Checked by Department Coordinator Principal

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

Course: Innovative Product Development-I (DJ19A2)

Pre-requisite: --

Objectives:

- 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.
- To familiarize the students with the process of designing and developing a product, while they work as part of a team.
- 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.
- 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 an innovative product.

4. Draw proper inferences through theoretical/ experimental/simulations and analyse the impact of the 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, which could eventually prepare themselves to be successful entrepreneurs.

7. Demonstrate product/project management principles during the design and development work and 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 accordingly select 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 over 2 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 can record weekly progress of work. The guide/supervisor should verify the recorded notes/comments and 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 a standard format and submitted to the department. Efforts are to be made by the students to try and publish 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 design and 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

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

Course: Constitution of India (DJ19A3)

Pre-requisite:

Objectives:

1. To provide basic information about Indian constitution.
2. To identify individual role and ethical responsibility towards society.
3. To understand human rights and its implications.

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

1. Have general knowledge and legal literacy and thereby to take up competitive examinations.
2. Understand state and central policies, fundamental duties.
3. Understand Electoral Process, special provisions.
4. Understand powers and functions of Municipalities, Panchayats and Co-Operative Societies,
5. Understand Engineering ethics and responsibilities of Engineers
6. Understand Engineering Integrity & Reliability

Constitution of India(DJ19A3)		
Unit	**Description**	**Duration**
1	**Introduction to the Constitution of India** The Making of the Constitution and Salient features of the Constitution. Preamble to the Indian Constitution Fundamental Rights & its limitations.	8
2	**Directive Principles of State Policy:** Relevance of Directive Principles State Policy Fundamental Duties. Union Executives – President, Prime Minister Parliament Supreme Court of India.	10
3	**State Executives:** Governor, Chief Minister, State Legislature High Court of State. Electoral Process in India, Amendment Procedures, 42nd, 44th, 74th, 76th, 86th & 91st Amendments	7
4	**Special Provisions:** For SC & ST Special Provision for Women, Children & Backward Classes Emergency	12

	Provisions. **Human Rights:** Meaning and Definitions, Legislation Specific Themes in Human Rights-Working of National Human Rights Commission in India Powers and functions of Municipalities, Panchayats and Co – Operative Societies	
5	**Scope & Aims of Engineering Ethics:** Responsibility of Engineers Impediments to Responsibility. Risks, Safety and liability of Engineers, Honesty, Integrity & Reliability in Engineering	7
	Total	**39**

Books Recommended:

Text books:

1. Durga Das Basu: "Introduction to the Constitution on India", (Students Edn.) Prentice –Hall EEE, 19th / 20th Edn., 2001

2. Charles E. Haries, Michael S Pritchard and Michael J. Robins "Engineering Ethics" Thompson Asia, 2003-08-05.

Reference Books:

1. M. V. Pylee, "An Introduction to Constitution of India", Vikas Publishing, 2002.

2. M. Govindarajan, S. Natarajan, V. S. Senthilkumar, "Engineering Ethics", Prentice – Hall of India Pvt. Ltd. New Delhi, 2004

3. Brij Kishore Sharma, "Introduction to the Constitution of India", PHI Learning Pvt. Ltd., New Delhi, 2011.

4. Latest Publications of Indian Institute of Human Rights, New Delhi

Website Resources:

1. www.nptel.ac.in
2. www.hnlu.ac.in
3. www.nspe.org
4. www.preservearticles.com

Prepared by Checked by Department Coordinator Principal