Faculty of Science & Technology
Savitribai Phule Pune University, Pune
Maharashtra, India

Curriculum
for
Second Year of Artificial Intelligence and Machine Learning (2020 Course)
(With effect from AY 2021-22)

I N D E X

Home

Savitribai Phule Pune University, Pune Bachelor of Artificial Intelligence(AI) & Machine Learning(ML)	
Program Educational Objectives	
PEO1	**Possess strong fundamental concepts in mathematics, science, engineering and Technology to address technological challenges.**
PEO2	**Possess knowledge and skills in the field of AI & ML for analyzing, designing and implementing complex engineering problems of any domain with innovative approaches.**
PEO3	**Possess an attitude and aptitude for research, entrepreneurship and higher studies in the field of Artificial Intelligence & Machine Learning**
PEO4	**Have commitment to ethical practices, societal contributions through communities and life-long learning.**
PEO5	**Possess better communication, presentation, time management and teamwork skills leading to responsible & competent professionals and will be able to address challenges in the field of AI & ML at global level.**

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Program Outcomes		
Students are expected to know and be able to–		
PO1	Engineering knowledge	An ability to apply knowledge of mathematics, computing, science, engineering and technology.
PO2	Problem analysis	An ability to define a problem and provide a systematic solution with the help of conducting experiments, analyzing the problem and interpreting the data.
PO3	Design / Development of Solutions	An ability to design, implement, and evaluate a software or a software/hardware system, component, or process to meet desired needs within realistic constraints.
PO4	Conduct Investigations of Complex Problems	An ability to identify, formulates, and provides systematic solutions to complex engineering/Technology problems.
PO5	Modern Tool Usage	An ability to use the techniques, skills, and modern engineering technology tools, standard processes necessary for practice as a IT professional.
PO6	The Engineer and Society	An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems with necessary constraints and assumptions.
PO7	Environment and Sustainability	An ability to analyze and provide solution for the local and global impact of information technology on individuals, organizations and society.
PO8	Ethics	An ability to understand professional, ethical, legal, security and social issues and responsibilities.
PO9	Individual and Team Work	An ability to function effectively as an individual or as a team member to accomplish a desired goal(s).
PO10	Communication Skills	An ability to engage in life-long learning and continuing professional development to cope up with fast changes in the technologies/tools with the help of electives, professional organizations and extra-curricular activities.
PO11	Project Management and Finance	An ability to communicate effectively in engineering community at large by means of effective presentations, report writing, paper publications, demonstrations.
PO12	Life-long Learning	An ability to understand engineering, management, financial aspects, performance, optimizations and time complexity necessary for professional practice.

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Program Specific Outcomes (PSO)	
A graduate of the Artificial Intelligence & Machine Learning Program will demonstrate-	
PSO1	An ability to apply the theoretical concepts and practical knowledge of Artificial Intelligence & Machine Learning in analysis, design, development and management of information processing systems and applications in the interdisciplinary domain.
PSO2	An ability to analyze a problem, and identify and define the computing infrastructure and operations requirements appropriate to its solution. AI & ML graduates should be able to work on large-scale computing systems.
PSO3	An understanding of professional, business and business processes, ethical, legal, security and social issues and responsibilities.
PSO4	Practice communication and decision-making skills through the use of appropriate technology and be ready for professional responsibilities.

Savitribai Phule Pune University, Pune
SE (Artificial Intelligence & Machine Learning Engineering) 2020 Course
(With effect from Academic Year 2021-22)

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Semester-III

Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks						Credit			
		Theory	Practical	Tutorial	IN-Sem	End-Sem	TW	PR	OR	Total	TH	PR	TUT	Total
218541	Discrete Mathematics	03	-	-	30	70	-	-	-	100	03	--	-	03
218542	Data Structures & Algorithms	03	-	-	30	70	-	-	-	100	03	--	-	03
218543	Computer Networks	03	-	-	30	70	-	-	-	100	03	--	-	03
218544	Object Oriented Programming	03	-	-	30	70	-	-	-	100	03	-	-	03
218545	Software Engineering	03	-	-	30	70	-	-	-	100	03	-	-	03
218546	Data Structures & Algorithms Laboratory	-	04	-	-	-	25	25	-	50	-	02	-	02
218547	Object Oriented Programming Laboratory	-	04	-	-	-	25	25	-	50	-	02	-	02
218548	Computer Networks Laboratory	-	02	-	-	-	25	25	-	50	-	01	-	01
218549	Humanities & Social Sciences	-	-	01	-	-	25	-	-	25	-	-	01	01
218550	Soft Skills	-	02	-	-	-	25	-	-	25	-	01	-	01
218551	Mandatory Audit Course 3*	-	-	-	-	-	-	-	-	-	Non Credit			-
Total		**15**	**12**	**01**	**150**	**350**	**125**	**75**	**--**	**700**	**15**	**06**	**01**	**22**

Abbreviations:

TH: Theory TW: Term Work PR: Practical

OR: Oral TUT: Tutorial

Note: Students of S.E. (Artificial Intelligence & Machine Learning) can opt any one of the audit courses from the list of audit courses prescribed by BoS (Information Technology Engineering)

***Mandatory Audit Course 3:** **218551** A- Ethics and values in IT

218551 B- Quantitative Aptitude and Logical Reasoning

218551 C- Language Study- Japanese- Module I

218551 D - Cyber Security and Laws

Savitribai Phule Pune University, Pune
SE (Artificial Intelligence & Machine Learning Engineering) 2020 Course
(With effect from Academic Year 2021-22)

Semester-IV

Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks						Credit			
		Theory	Practical	Tutorial	IN-Sem	End-Sem	TW	PR	OR	Total	TH	PR	TUT	Total
207003	Applied Mathematics	03	-	-	30	70	-	-	-	100	03	-	-	03
218552	Operating Systems	03	-	-	30	70	-	-	-	100	03	-	-	03
218553	Fundamentals of Artificial Intelligence and Machine Learning	03	-	-	30	70	-	-	-	100	03	-	-	03
218554	Database Management System	03	-	-	30	70	-	-	-	100	03	-	-	03
218555	Computer Graphics	03	-	-	30	70	-	-	-	100	03	-	-	03
218556	Operating Systems Laboratory	-	02				25	25	-	50		02	-	01
218557	Computer Graphics Laboratory	-	02					25	-	25				01
218558	DBMS Laboratory	-	04	-	-		25	25	-	50		02	-	02
218559	Project Based Learning II	-	04	-	-	-	50	-	-	50	-	02	-	02
218560	Code of Conduct	-	-	01	-	-	25	-	-	25	-	-	01	01
218561	Mandatory Audit Course 4#	-	-	-	-	-	-	-	-	-	Non Credit			-
Total		**15**	**12**	**01**	**150**	**350**	**125**	**75**	**-**	**700**	**15**	**06**	**01**	**22**

Abbreviations:

TH: Theory TW: Term Work PR: Practical

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Note: Students of S.E. (Artificial Intelligence & Machine Learning) can opt any one of the audit Courses from the list of audit courses prescribed by BoS (Information Technology Engineering)

#Mandatory Audit Course 4:

218561 A - Water Supply and Treatment

218561 B - Language Study- Japanese- Module II

218561 C - Waste Management and Pollution Control

218561 D - Intellectual Property Rights

INSTRUCTIONS

- Practical or Tutorial must be conducted in batches and number of batches per division should be as per guidelines from regulatory bodies.
- Required minimum number of experiments/ assignments in practical/ tutorial shall be conducted as mentioned in the syllabi of respective subjects. The list of experiments/assignments is prescribed in the syllabi.
- In addition to the prescribed list, the instructor for practical/ tutorial may design one or two additional experiments/assignments relating to the subject covering some of the research/application areas of the concerned subject.
- For practical/tutorial subject, each experiment/assignment, the student must prepare a write-up consisting of assignment statement, objective(s)/outcome(s), algorithm(s), flow charts/UML diagram(s), important test cases, test case validation report etc.
- The faculty member/instructor should prepare a rubric for the assessment of practical and tutorial. Assessment of tutorial work is part of term-work examination. Term-work Examination at second year of engineering course shall be internal continuous assessment only**.**
- Project based learning (PBL) requires mentoring and internal continuous assessment by faculty throughout the semester for successful completion of the tasks assigned to the students. A teaching workload of 4 hours/week/batch is associated with PBL subject should be allocated to the faculty conducting PBL mentoring and internal continuous assessment. The students in a Batch may be divided into sub-groups of 5 to 6 students for easing the process of internal continuous assessment. Assignments/activities/models/ projects etc. completed under project-based learning will be considered for internal continuous assessment, evaluation, and award of credits for PBL subjects.
- Audit course is a mandatory non-credit course. The faculty member should prepare the rubric(s) for the assessment of audit course at the start of semester. The assessment should be carried out based on the said rubric(s) only and report should be prepared and submitted to the department at the end of semester.
- Case Studies may be assigned as a self-study to students and to be excluded from theory examinations.
- All the rules, regulations and guidelines issued by regulatory authorities from time to time for effective conduction of curriculum, assessment and evaluation are to be strictly followed.

SEMESTER – III

Home

Savitribai Phule Pune University, Pune
Second Year Artificial Intelligence & Machine Learning (2020 Course)
218541 : Discrete Mathematics

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory (TH) : 03 hrs/week	03	Mid_Semester : 30 Marks End_Semester : 70 Marks

Prerequisite Courses, if any: Basic Mathematics

Companion Course, if any:

Course Objectives:

1. To gain sound knowledge to formulate and solve problems with sets and propositions.
2. To understand and solve counting problems by applying elementary counting techniques to solve problems of discrete probability.
3. To understand Graph and Tree terminologies and models to be applied in real life problems.
4. To recognize types of relation, formulate and solve problems with relations and functions.
5. To understand basics of number theory and its applications.
6. To understand the various types' algebraic structures and its applications.

Course Outcomes:

On completion of the course, students will be able to–

CO1: Formulate and apply formal proof techniques and solve the problems with logical reasoning.
CO2: Analyze and evaluate the combinatorial problems by using probability theory.
CO3: Apply the concepts of graph theory to devise mathematical models.
CO4: Analyze types of relations and functions to provide solution to computational problems.
CO5: Identify techniques of number theory and its application.
CO6: Identify fundamental algebraic structures.

COURSE CONTENTS

Unit I	Sets And Propositions	(06 hrs)

Sets: Sets, Combinations of Sets, Venn Diagram, Finite and Infinite Sets, Countable Sets, Multisets, Principle of Inclusion and Exclusion, Mathematical Induction.

Propositions: Propositions, Logical Connectives, Conditional and Bi-conditional Propositions, Logical Equivalence, Validity of Arguments by using Truth Tables, Predicates and Quantifiers, Normal forms. Applications of Sets and Propositions.

Mapping of Course Outcomes for Unit I	CO1

Unit II	Combinatorics And Discrete Probability	(06 hrs)

Combinatorics: Rules of Sum and Product, Permutations, Combinations.

Discrete Probability: Discrete Probability, Conditional Probability, Bayes Theorem, Information and Mutual Information, Applications of Combinatorics and Discrete Probability.

Mapping of Course Outcomes for Unit II	**CO2**	
Unit III	**Graph Theory**	**(06 hrs)**
Graphs: Basic Terminologies, Multi-Graphs, Weighted Graphs, Sub Graphs, Isomorphic graphs, Complete Graphs, Regular Graphs, Bipartite Graphs, Operations on Graphs, Paths, Circuits, Hamiltonian and Eulerian graphs, Travelling Salesman Problem, Factors of Graphs, Planar Graphs, Graph Colouring. **Trees:** Tree Terminologies, Rooted Trees, Path Length in Rooted Trees, Prefix Codes, Spanning Trees, Fundamental Cut Sets and Circuits, Max flow –Min Cut Theorem (Transport Network). Applications of Graph Theory.		
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**Relations And Functions**	**(06 hrs)**
Relations: Properties of Binary Relations, Closure of Relations, Warshall's Algorithm, Equivalence Relations, Partitions, Partial Ordering Relations, Lattices, Chains and Anti Chains. **Functions:** Functions, Composition of Functions, Invertible Functions, Pigeonhole Principle, Discrete Numeric Functions. **Recurrence Relations:** Recurrence Relation, Linear Recurrence Relations with Constant Coefficients, Total Solutions, Applications of Relations and Functions.		
Mapping of Course Outcomes for Unit IV	**CO4**	
Unit V	**Introduction To Number Theory**	**(06 hrs)**
Divisibility of Integers: Properties of Divisibility, Division Algorithm, Greatest Common Divisor GCD and its Properties, Euclidean Algorithm, Extended Euclidean Algorithm, Prime Factorization Theorem, Congruence Relation, Modular Arithmetic, Euler Phi Function, Euler's Theorem, Fermat's Little Theorem, Additive and Multiplicative Inverses, Chinese Remainder Theorem.		
Mapping of Course Outcomes for Unit V	**CO5**	
Unit VI	**Algebraic Structures**	**(06 hrs)**
Algebraic Structures: Introduction Semigroup, Monoid, Group, Abelian Group, Permutation Groups, Cosets, Normal Subgroup, Codes and Group Codes, Ring, Integral Domain, Field. Applications of Algebraic Structures.		
Mapping of Course Outcomes for Unit VI	**CO6**	
Text Books:		
1. C. L. Liu and D. P. Mohapatra, "Elements of Discrete Mathematics", 4th Edition, McGraw-Hill 2. Kenneth H. Rosen, "Discrete Mathematics and its Applications", & 7th edition, McGraw-Hill		

Reference Books:

1. Bernard Kolman, Robert C. Busby, Sharon Cutler Ross, "Discrete mathematical structures", 6th edition, Prentice Hall of India
2. Edgar G. Goodaire, Michael M. Parmenter, "Discrete Mathematics with Graph Theory", 3rd Edition, Pearson Education
3. Tremblay J. S., "Discrete mathematical structures with application", 3rdEdition, Tata McGraw Hill
4. Lipschutz Seymour, "Discrete mathematics", 4th Edition, Tata McGraw-Hill
5. Johnsonbaugh Richard, "Discrete Mathematics", 7th edition, Pearson
6. Biggs Norman L, "Discrete mathematics", 6th edition, Oxford
7. David M. Burton, "Elementary Number Theory", &7th Edition, McGraw-Hill

Home

Savitribai Phule Pune University, Pune
Second Year Artificial Intelligence & Machine Learning (2020 Course)
218542:Data Structure & Algorithms

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory(TH):03hrs/week	03	Mid_Semester: 30 Marks End_Semester: 70 Marks

Prerequisite Courses, if any: Fundamental knowledge of programming language and basics of algorithms

Companion Course, if any: Discrete Structures/Discrete Mathematics

Course Objectives:

1. To study data structures and their implementations and applications.
2. To learn different searching and sorting techniques.
3. To study some advanced data structures such as trees, graphs and tables.
4. To learn different file organizations.
5. To learn algorithm development and analysis of algorithms.

Course Outcomes:

On completion of the course, students will be able to–

CO1: Perform basic analysis of algorithms with respect to time and space complexity.
CO2: Select appropriate searching and/or sorting techniques in the application development.
CO3: Implement abstract data type (ADT) and data structures for given application.
CO4: Design algorithms based on techniques like brute -force, divide and conquer, greedy, etc.
CO5: Apply implement learned algorithm design techniques and data structures to solve problems.
CO6: Design different hashing functions and use files organizations.

COURSE CONTENTS

Unit- I	Introduction	07hrs

Introduction to Data Structures: Concept of data, Data object, Data structure, Concept of Primitive and non-primitive, linear and Nonlinear, static and dynamic, persistent and ephemeral data structures, Definition of ADT
Analysis of algorithm: Frequency count and its importance in analysis of an algorithm, Time complexity & Space complexity of an algorithm Big 'O', 'Ω' and 'Θ' notations,
Sequential Organization: Single and multidimensional array and address calculation.
Linked Organization: Concept of linked organization, Singly Linked List, Doubly Linked List, Circular Linked List (Operations: Create, Display, Search, Insert, Delete).

Case Study	**Set Operation, String Operation**
Mapping of Course Outcomes for Unit I	**CO1, CO3, CO5**

Unit- II	Searching and Sorting	06 hrs

Searching and sorting: Need of searching and sorting, Concept of internal and external sorting, sort stability, Searching methods: Linear and binary search algorithms, Fibonacci Series.
Sorting methods: Bubble, insertion, Quick, Merge, shell and comparison of all sorting methods.
Analyze Insertion sort, Quick Sort, binary search, hashing for Best, Worst and Average case.

Case Study	**Study and Analyze Selection sort, bucket sort, radix sort.**	
Mapping of Course Outcomes for Unit II	**CO1, CO2, CO4, CO5**	
Unit- III	**Stack &Queue**	**06 hrs**
Stack: Concept of stack, Concept of implicit and explicit stack, stack as an ADT using sequential and linked organization, Applications of stack: recursion, converting expressions from infix to postfix or prefix form, evaluating postfix or prefix form. **Queue:** Concept of queues as ADT, Implementation of queue using array and linked organization, Concept of circular queue, double ended queue, Applications of queue: priority queue.		
Case Study	**Reversing a string, balanced parentheses in algebraic expressions, Towers of Hanoi problem, double ended queue as Stack and Queue.**	
Mapping of Course Outcomes for Unit III	**CO1, CO3, CO4,CO5**	
Unit- IV	**Trees**	**06 hrs**
Tree : Trees and binary trees-concept and terminology, Expression tree, Binary tree as an ADT, , Binary search tree, Recursive and Non recursive algorithms for binary tree traversals ,Binary search tree as ADT(Insert Search Delete, level wise Display) **Threaded binary tree:** Concept of threaded binary tree (inorder, preorder and postorder). Preorder and In-order traversals of in-order threaded binary tree, Applications of trees.		
Case Study	**Construction of BST from pre and postorder traversal, Expression Tree construction**	
Mapping of Course Outcomes for Unit IV	**CO1, CO2, CO3, CO5**	
Unit- V	**Graph and Symbol Table**	**07hrs**
Graph -Concept and terminologies, Graph as an ADT, Representation of graphs using adjacency matrix and adjacency list, Breadth First Search traversal, Depth First Search traversal, Prim's and Kruskal's algorithms for minimum spanning tree, Shortest path using Dijkstra's algorithm, topological sorting. **Symbol Table -**Notion of Symbol Table, OBST, AVL Trees Heap: Heap data structure, Min and Max Heap, Heap sort, applications of heap		
Case Study	**Consider a network of computers connected to each other. The connection has various parameters associated with it as distance, propagation delay, bandwidth (capacity of carrying data), etc. Based on these parameters, decide which path should be chosen to send data from one computer to every other on the network.** **In a system, jobs are submitted for execution at different times. If the system is idle, the job is taken for executed immediately. If there is a job in execution, the newly submitted job is added to a queue. The jobs are assigned a number, which indicates tells the priority of the jobs. The system must execute the high priority jobs first for execution. Implement the above said system using heap data structure.**	

Mapping of Course Outcomes for Unit V	**CO1, CO2, CO3, CO4, CO5**	
Unit- VI	**Hashing and File Organization**	**06 hrs**
Hashing: Hash tables and scattered tables: Basic concepts, hash function, characteristics of good hash function, Different key-to-address transformations techniques, synonyms or collisions, collision resolution techniques- linear probing, quadratic probing, rehashing, chaining with and without replacement. **File:**Concept of File, File types and file organization (sequential, index sequential and Direct Access), Comparison of different file organizations.		
Case Study	**What are the advantages of binary tree and binary search in file handling? Study Hashing techniques for expandable Files(Extendible, Dynamic and Linear Hashing)**	
Mapping of Course Outcomes for Unit VI	**CO1, CO3,CO5,CO6**	

Text Books:

1. E. Horowitz, S. Sahni, D. Mehta, "Fundamentals of Data Structures in C++", Galgotia Book Source, New Delhi, 1995, ISBN 16782928
2. Y. Langsam, M. Augenstin, A. Tannenbaum, "Data Structures using C and C++", 2nd Edition, Prentice Hall of India, 2002, ISBN-81-203-1177-9.

Reference Books:

1. G. A.V, PAI , “Data Structures and Algorithms “, McGraw Hill, ISBN -13: 978-0-07-066726-6
2. A. Tharp ,"File Organization and Processing", 2008 ,Willey India edition, 9788126518685
3. M. Folk, B. Zoellick, G. Riccardi, "File Structure An Object Oriented Approach with C++", Pearson Education, 2002, ISBN 81 - 7808 - 131 - 8.
4. M. Welss, “Data Structures and Algorithm Analysis in C++", 2nd edition, Pearson Education, 2002, ISBN-81-7808-670-0

Home

Savitribai Phule Pune University, Pune
Second Year Artificial Intelligence & Machine Learning (2020 Course)
218543: Computer Networks

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory (TH) : 03 hrs/week	03	Mid_Semester : 30 Marks End_Semester : 70 Marks

Prerequisite Courses, if any: Basics of Communications

Companion Course, if any:

Course Objectives:

1. To understand the fundamentals of communication system.
2. To understand the basics of internetworking.
3. To understand services and protocols used at Physical, Data Link, Network, Transport and Application Layer

Course Outcomes:

On completion of the course, students will be able to–

CO1: Understand data/signal transmission over communication media.

CO2: Understand basics of computer networking and **compare** functions of OSI and TCP/IP model using concepts of communication theory.

CO3: Analyze data link layer services**,** different access techniques, and Ethernet standards.

CO4: Understand the network layer services, **apply** skills of subnetting, supernetting and routing mechanisms.

CO5: Illustrate services and protocols used at transport layer.

CO6: Understand and learn the different application layer protocols.

COURSE CONTENTS

Unit I	Basics of data communication	(06 hrs)

Signals: Types of Signals, A/D, D/A, A/A, D/D Signal Conversion Methods, Bandwidth Utilization and Data Rate Limits, Multiplexing Techniques.

Modulation: Introduction, Need for Modulation, Electromagnetic Spectrum and typical Applications.

Noise: Types of noise, Shannon Hartley Theorem, Channel capacity, Nyquist and Shannon Theorem, Bandwidth S/N trade off.

Mapping of Course Outcomes for Unit I	CO1

Unit II	Introduction to basics of Computer Networking	(06 hrs)

Computer network fundamentals
Networking Reference Models: ISO OSI Model, TCP/IP Protocol Suite.
Addressing : Physical addressing, Logical addressing, Port addressing and other addressing
Types of network: LAN, WAN, MAN, PAN.
Network architecture: Peer to Peer network architecture, Server client network architecture.
Network Topologies: Bus Topology, Star Topology, Ring Topology, Mesh Topology, and Hybrid Topology with advantages and disadvantages.
Types of cable connection: Straight through connection, Cross over Connection.
Guided Media: Twisted Pair Cable, Coaxial Cable and Fiber-Optic Cable.
Unguided Media: Wireless, Radio Waves, Microwaves and Infrared, Wireless frequency spectrum.
Network connecting devices: Router, Switch, bridge, hub, repeaters, and its comparisons

Mapping of Course Outcomes for Unit II	**CO2**

Unit III	**Data Link Layer**	**(06 hrs)**

Data Link Layer Services
Error Detection and Correction: Introduction, Error Detection, Error Correction.
Linear Block Codes: Hamming code, Hamming Distance, parity check code.
Cyclic Codes: CRC (Polynomials), Advantages of Cyclic Codes**.**
Checksum: One's Complement, Internet Checksum.
Framing: fixed-size framing, variable size framing**.**
Flow control: flow control protocols.
Noiseless channels: simplest protocol, stop-and-wait protocol.
Noisy channels: stop-and-wait Automatic Repeat Request (ARQ), go-back-n ARQ, Selective repeat ARQ.
Random Access Techniques: CSMA, CSMA/CD, CSMA/CA
Ethernet: IEEE Standards: 802.3, 802.4, 802.5, 802.6 Comparisons of Standard Ethernet, Fast Ethernet, Gigabit Ethernet**.**

Mapping of Course Outcomes for Unit III	**CO3**

Unit IV	**Network Layer**	**(06 hrs)**

Network Layer Services
IPv4 Addresses: Classful and Classless Addressing, Subnet Mask, Subnetting, Supernetting, Delivery and Forwarding of IP Packet, IPv4 header and Fragmentation, private IPv4 addresses, Public IPv4 addresses, NAT.
IPv6 addresses: Header, Types of IPv6 addresses
Structure of Router
Network layer protocols: ARP, RARP, DHCP, ICMPv4.
Routing: Metric, Routing Tables, Static routing, dynamic routing, Default Routing.
Unicast Routing Protocols : Distance vector routing, Link State routing, Path vector routing
Interior Gateway Routing Protocols: RIP, EIGRP, OSPF
Exterior Gateway Routing Protocol: BGP

Mapping of Course Outcomes for Unit IV	**CO4**

Unit V	**Transport Layer**	**(06 hrs)**
Transport Layer Services, Transport Layer Protocols. **UDP:** UDP header, Services, Applications**.** **TCP:** Services, Features, Segment, TCP Header, TCP Connection, Window in TCP, TCP Timers, Options, TCP Package**.** **Applications:** SCTP: Features, Services, Packet Format **Flow control protocols** **Congestion Control protocols:** Congestion Control Algorithms, Leaky Bucket, Token Bucket and QoS. **Socket:** TCP and UDP Socket, Applications.		
Mapping of Course Outcomes for Unit V	**CO5**	
Unit VI	**Application Layer**	**(06 hrs)**
Application layer services : Client Server Paradigm, Peer to Peer Paradigm, Communication using TCP and UDP services. **Application Layer Protocols:** DNS, FTP, TFTP, HTTP, SMTP, POP, IMAP, MIME. **Network Management:** SNMP.		
Mapping of Course Outcomes for Unit VI	**CO6**	

Text Books:

1. Behrouz A. Forouzan, TCP/IP Protocol Suite, McGraw Hill Education, ISBN: 978-0-07-070652-1, 4th Edition.

2. Andrew S. Tanenbaum, David J. Wethrall, Computer Network, Pearson Education, ISBN: 978-0-13-212695-3.

Reference Books:

1. Kurose Ross, Computer Networking: A Top Down Approach Featuring the Internet, Pearson Education, ISBN: 978-81-7758-878-1.

2. Behrouz A. Forouzan, Data Communication and Networking, McGraw Hill Education, ISBN: 978-1-25-906475-3, 5th Edition.

3. Mayank Dave, Computer Network, Cengage Learning, ISBN: 978-81-315-0986-9.

Home

Savitribai Phule Pune University
Second Year Artificial Intelligence & Machine Learning (2020 Course)
218544: Object Oriented Programming

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory (TH): 03hrs/Week	03	Mid_Semester: 30 Marks End_Semester: 70 Marks

Prerequisites: Principles of Programming Languages

Course Objectives:

1. Apply concepts of object-oriented paradigm.
2. Design and implement models for real life problems by using object-oriented programming.
3. Develop object-oriented programming skills.

Course Outcomes:

On completion of the course, students will be able to–

CO1: Differentiate various programming paradigms.

CO2: Identify classes, objects, methods, and handle object creation, initialization, and Destruction to model real-world problems.

CO3: Identify relationship among objects using inheritance and polymorphism principles.

CO4: Handle different types of exceptions and perform generic programming.

CO5: Use of files for persistent data storage for real world application.

CO6: Apply appropriate design patterns to provide object-oriented solutions.

COURSE CONTENTS

Unit I	Foundations of Object Oriented Programming	06 hrs

Introduction OOP : Software Evolution, Introduction to Procedural, Modular, Object-Oriented and Generic Programming Techniques, Limitations of Procedural Programming, Need of Object-Oriented Programming, Fundamentals of Object-Oriented Programming: Objects, Classes, Data Members, Methods, Messages, Data Encapsulation, Data Abstraction and Information Hiding, Inheritance, Polymorphism, Static and Dynamic Binding, Message Passing.

Case Study	**Model a real world scenario (vehicle class, fruit class, student management in university etc.) using Object Oriented Paradigm**
Mapping Course Outcomes for Unit 1	**CO1**

Unit II	Classes, Objects and Methods	06 hrs

Class: Creating a Class, Visibility/Access Modifiers, Encapsulation, Methods: Adding a Method to Class, Returning a Value, Adding a Method That Takes Parameters, The 'this' Keyword, Method Overloading, Object Creation, Using Object as a Parameters, Returning Object, Array of Objects, Memory Allocation: 'new', Memory Recovery: 'delete', Static Data Members, Static Methods, Forward Declaration, Class as Abstract Data Types (ADTs), Classes as Objects.

Case Study	**Represent a vector using class and include appropriate methods to perform various tasks.**	
Mapping of Course Outcomes for Unit II	**CO2**	
Unit III	**Constructors and Destructors**	**06 hrs**
Constructors: Introduction, Use of Constructor, Characteristics of Constructors, Types of Constructor, Constructor Overloading, Dynamic Initialization of an Object, Constructor with Default Arguments, Symbolic Constants, Garbage Collection: Destructors and Finalizes.		
Case Study	**A book shop inventory**	
Mapping of Course Outcomes for Unit III	**CO2**	
Unit IV	**Inheritance and Polymorphism**	**06 hrs**
Inheritance: Introduction, Need of Inheritance, Types of Inheritance, Benefits of Inheritance, Cost of Inheritance, Constructors in derived Classes, Method Overriding, Abstract Classes and Interfaces. Polymorphism and Software Reuse: Introduction, Types of Polymorphism (Compile Time and Run Time Polymorphism), Mechanisms for Software Reuse, Efficiency and Polymorphism		
Case Study	**A bank account system**	
Mapping of Course Outcomes for Unit IV	**CO3**	
Unit V	**Exception Handling and Generic Programming**	**06 hrs**
Exception: Errors, Types of Errors, Exception and its Types, Exception-Handling Fundamentals, Uncaught Exception, Using try and Catch, Multiple Catch Clauses, Nested Try Statements, User Define Exception using Throw. **Generics:** What are Generics? Introduction to Language Specific Collection Interface: List Interface and Set Interface, Collection Classes: ArrayList Class and LinkedList Class.		
Case Study	**Exception handling and generic programming using array list (ArrayList class)**	
Mapping of Course Outcomes for Unit V	**CO4**	
Unit VI	**File Handling and Design Patterns**	**06 hrs**
File Handling: Introduction, Concepts of Stream, Stream Classes, Byte Stream Classes, Character Stream, Classes, Using Stream, and Other Useful I/O Classes, Using the File Class, Input/output Exceptions, Creation of Files, Reading/Writing Character, Reading/Writing Bytes, Handling Primitive Data Types, Concatenating and Buffering Files, Random Access Files. **Design Patterns:** Introduction, Types of Design Patterns, Adapter, Singleton, Iterator		
Case Study	**Student Management System**	
Mapping of Course Outcomes for Unit VI	**CO5 and CO6**	

Text Book:
1. An Introduction to Object Oriented Programming (3rd Ed), by Timothy A. Budd, published by Addison-Wesley,2002 2. E. Balaguruswamy, "Object Oriented Programming Using C++ and Java", Tata McGraw Hill
Reference Books:
1. Object-Oriented Programming and Java by Danny Poo (Author), Derek Kiong (Author), Swarnalatha Ashok (Author)Springer; 2nd ed. 2008 edition (12 October 2007), ISBN-10: 1846289629, ISBN-13: 978-1846289620,2007 2. Java The complete reference, 9th edition, Herbert Schildt, McGraw Hill Education (India) Pvt. Ltd. 3. Object-Oriented Design Using Java, Dale Skrien, McGraw-Hill Publishing, 2008, ISBN - 0077423097, 9780077423094. 4. UML for Java Programmers by Robert C. Martin, Prentice Hall, ISBN 0131428489, 2003.

Home

Savitribai Phule Pune University, Pune
Second Year Artificial Intelligence & Machine Learning (2020 Course)
218545 : Software Engineering

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory(TH) : 03 hrs/week	03	Mid_Semester: 30 Marks End_Semester: 70 Marks

Prerequisite Courses, if any: Fundamentals of Programming Languages

Course Objectives:

1. To learn the principles of Software Engineering.
2. To learn and understand methods of capturing, specifying, visualizing and analyzing software requirements.
3. To know design principles to software project development.
4. To learn basics of IT project management.
5. To understand software quality attributes and testing principles.
6. To introduce formal methods and recent trends in Software Engineering.

Course Outcomes:

On completion of the course, students will be able to --

CO1: Classify various software application domains.
CO2: Analyze software requirements by using various modeling techniques.
CO3: Translate the requirement models into design models.
CO4: Apply planning and estimation to any project.
CO5: Use quality attributes and testing principles in software development life cycle.
CO6: Discuss recent trends in Software engineering by using CASE and agile tools.

COURSE CONTENTS

Unit I	Introduction To Software Engineering	06 hrs

Software Engineering Fundamentals: Nature of Software, Software Engineering Practice, Software Process, Software Myths.
Process Models : A Generic Process Model, Linear Sequential Development Model, Iterative Development Model, The incremental Development Model
Agile software development: Agile manifesto, agility principles, Agile methods, myth of planned development, Introduction to Extreme programming and Scrum.
Agile Practices: test driven development, pair programming, continuous integration in DevOps , Refactoring

Case Study	**An information system – Library Management system**
Mapping of Course Outcomes for Unit I	**CO1**

Unit II	Requirements Engineering & Analysis	06 hrs

Requirements Engineering: User and system requirements, Functional and non-functional requirements, requirements engineering (elicitation, specification, validation, negotiation) prioritizing requirements (Kano diagram), requirement traceability matrix(RTM)

Software Requirements Specification (SRS): software requirements Specification document, structure of SRS, writing a SRS, structured SRS for online shopping, **Requirements Analysis:** Analysis Model, data modeling, scenario based modeling, class based modeling, Flow oriented modeling, behavioral modeling-Introduction to UML diagrams		
Case Study : Library Management system		
Mapping of Course Outcomes for Unit II	**CO2**	
Unit III	**Design Engineering**	**06 hrs**
Design Engineering : Design Process & quality, Design Concepts, design Model, Pattern-based Software Design. Architectural Design :Design Decisions, Views, Patterns, Application Architectures **Component level Design:** component, Designing class based components, conducting component-level design, User Interface Design: The golden rules, Interface Design steps& Analysis, Design Evaluation		
Case Study : Web App Design / Library Management System		
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**Project Planning, Management And Estimation**	**6 hrs**
Project Planning: Project initiation, Planning Scope Management, Creating the Work Breakdown Structure, scheduling: Importance of Project Schedules, Developing the Schedule using Gantt Charts, PERT/ CPM **Project Management:** The Management Spectrum, People, Product, Process, Project, The W5HH Principle, Metrics in the Process and Project Domains, Software Measurement: size &function-oriented metrics(FP & LOC), Metrics for Project **Project Estimation:** Software Project Estimation, Decomposition Techniques, Cost Estimation Tools and Techniques, Typical Problems with IT Cost Estimates.		
Case Study: Project Management tool like OpenProj or MS Project		
Mapping of Course Outcomes for Unit IV	**CO4**	
Unit V	**Software Quality And Testing**	**06 hrs**
Quality Concepts: Quality, software quality, Quality Metrics, software quality dilemma, achieving software quality **Software Testing:** Introduction to Software Testing, Principles of Testing, Test plan, Test case, Types of Testing, Verification & Validation, Testing strategies, Defect Management, Defect Life Cycle, Bug Reporting, debugging.		
Case Study : Software testing tool like selenium		
Mapping of Course Outcomes for Unit V	**CO5**	
Unit VI	**Formal Methods Recent Trends In Software Engineering**	**06 hrs**
Recent Trends in SE : SCM, Risk Management, Technology evolution, process trends, collaborative development, software reuse, test-driven development, global software development challenges, CASE – taxonomy, tool-kits, workbenches, environments, components		

of CASE, categories (upper, lower and integrated CASE tools), Introduction to agile tools Jira, Kanban
Case Study : CASE software/ HP Quality Center (QC) / Jira

Mapping of Course Outcomes for Unit VI	**CO6**

Text Books:

1. Roger Pressman, "Software Engineering:A Practitioner's Approach", McGraw Hill,ISBN 0-07-337597-7
2. Ian Sommerville, "Software Engineering",Addison and Wesley, ISBN 0-13-703515-2

Reference Books:

1. 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
2. Pankaj Jalote, "Software Engineering: A Precise Approach", Wiley India, ISBN: 9788-1265-2311-5
3. Marchewka, "Information Technology Project Management", Willey India, ISBN: 9788-1265-4394-6
4. Rajib Mall, "Fundamentals of Software Engineering", Prentice Hall India, ISBN-13:9788-1203-4898-1

Home

Savitribai Phule Pune University, Pune
Second Year Artificial Intelligence & Machine Learning (2020 Course)
218546 : Data Structure & Algorithms Laboratory

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical (PR) : 04 hrs/week	02	PR : 25 Marks TW: 25 Marks

Prerequisite Courses, if any: Fundamental knowledge of programming language and basics of algorithms

Course Objectives:

1. To study data structures and their implementations and applications.
2. To learn different searching and sorting techniques.
3. To study some advanced data structures such as trees, graphs and tables.
4. To learn different file organizations.
5. To learn algorithm development and analysis of algorithms.

Course Outcomes:

On completion of the course, students will be able to–

CO1: Analyze algorithms and to determine algorithm correctness and time efficiency class.
CO2: Implement abstract data type (ADT) and data structures for given application.
CO3: Design algorithms based on techniques like brute -force, divide and conquer, greedy, etc.).
CO4: Solve problems using algorithmic design techniques and data structures.
CO5: Analyze of algorithms with respect to time and space complexity.

Guidelines for Instructor's Manual

The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/Assistant.

The instructor's manual should include prologue, university syllabus, conduction & Assessment guidelines, topics under consideration-concept, objectives, outcomes, algorithm written in pseudo language, sample test cases and references. Experiments to be conducted in C++.

Guidelines for Student's Lab Journal

1. The laboratory assignments are to be submitted by students in the form of journals. The Journal consists of prologue, Certificate, table of contents, and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory-Concept, algorithms, printouts of the code written using coding standards, sample test cases etc.)
2. Practical Examination will be based on the term work.
3. Candidate is expected to know the theory involved in the experiment.
4. The practical examination should be conducted if the journal of the candidate is completed in all respects and certified by concerned faculty and head of the department.

5. All the assignment mentioned in the syllabus must be conducted.

Guidelines for Lab /TW Assessment

1. Examiners will assess the term work based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of handwritten write-up along with results of implemented assignment, attendance etc.
2. Examiners will judge the understanding of the practical performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried out.
3. Appropriate knowledge of usage of software and hardware such as compiler, debugger, coding standards, algorithm to be implemented etc. should be checked by the concerned faculty member(s).

Guidelines for Laboratory Conduction

The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The instructor may set multiple sets of assignments and distribute among batches of students. It is appreciated if the assignments are based on real world problems/applications.

All the assignments should be conducted on multicore hardware and 64-bit open-source software.

Guidelines for Practical Examination

Both internal and external examiners should jointly set problem statements for practical examination. During practical assessment, the expert evaluator should give the maximum weightage to the satisfactory implementation of the problem statement. The supplementary and relevant questions may be asked at the time of evaluation to judge the student's understanding of the fundamentals, effective and efficient implementation. The evaluation should be done by both external and internal examiners.

List of Assignments

Virtual Laboratory

- **https://ds1-iiith.vlabs.ac.in/data-structures-1/**
- **https://ds2-iiith.vlabs.ac.in/data-structures-2/**
- **http://cse01-iiith.vlabs.ac.in/**

1. Searching and Sorting -- CO1, CO2, CO3, CO5

Consider a student database of SEIT class (at least 15 records). Database contains different fields of every student like Roll No, Name and SGPA.(array of structure)

a) Design a roll call list, arrange list of students according to roll numbers in ascending order (Use Bubble Sort)
b) Arrange list of students alphabetically. (Use Insertion sort)
c) Arrange list of students to find out first ten toppers from a class. (Use Quick sort)
d) Search students according to SGPA. If more than one student having same SGPA, then print list of all students having same SGPA.
e) Search a particular student according to name using binary search without recursion. (all the

student records having the presence of search key should be displayed)

(Note: Implement either Bubble sort or Insertion Sort.)

2. Stack -- CO1, CO2, CO3, CO5

Implement stack as an abstract data type using singly linked list and use this ADT for conversion of infix expression to postfix, prefix and evaluation of postfix and prefix expression.

3. Circular Queue -- CO1, CO2, CO3, CO5

Implement Circular Queue using Array. Perform following operations on it.

a) Insertion (Enqueue)
b) Deletion (Dequeue)
c) Display

(Note: Handle queue full condition by considering a fixed size of a queue.)

4. Expression Tree -- CO1, CO2, CO3, CO5

Construct an Expression Tree from postfix and prefix expression. Perform recursive and non- recursive In-order, pre-order and post-order traversals.

5. Binary Search Tree -- CO1, CO2, CO3, CO5

Implement binary search tree and perform following operations:

a) Insert (Handle insertion of duplicate entry)
b) Delete
c) Search
d) Display tree (Traversal)
e) Display - Depth of tree
f) Display - Mirror image
g) Create a copy
h) Display all parent nodes with their child nodes
i) Display leaf nodes
j) Display tree level wise

(Note: Insertion, Deletion, Search and Traversal are compulsory, from rest of operations, perform Any three)

6. Threaded Binary Tree -- CO1, CO2, CO3, CO5

Implement In-order Threaded Binary Tree and traverse it in In-order and Pre-order.

7. Graph: Minimum Spanning Tree -- CO1, CO2, CO3, CO5

Represent a graph of your college campus using adjacency list /adjacency matrix. Nodes should represent the various departments/institutes and links should represent the distance between them. Find minimum spanning tree

a) Using Kruskal's algorithm.
b) Using Prim's algorithm.

8. Graph: Shortest Path Algorithm -- CO1, CO2, CO3, CO5

Represent a graph of city using adjacency matrix /adjacency list. Nodes should represent the various landmarks and links should represent the distance between them. Find the shortest path using Dijkstra's algorithm from single source to all destination.

9. Heap Sort -- CO1, CO2, CO4

Implement Heap sort to sort given set of values using max or min heap.

10. FILE Handling -- CO1, CO3, CO5

Department maintains student's database. The file contains roll number, name, division and address. Write a program to create a sequential file to store and maintain student data. It should allow the user to add, delete information of student. Display information of particular student. If record of student does not exist an appropriate message is displayed. If student record is found it should display the student details.

Text Books :

1. Richard F. Gilberg, Behrouz A. Forouzan, "Data Structures: A Pseudocode Approach using C++", Cengage Learning, 5th Edition, ISBN 978-8131504925
2. Mark Allen Weiss, "Data structures and Algorithm Analysis in C++ ", Pearson Education India, 3 edition (2007), ISBN 978-8131714744
3. Ellis Horowitz, Sartaj Sahni, Dinesh Mehta, "Fundamentals of Data Structures in C++", University Press (2008), ISBN 978-8173716065

Reference Books

1. Hemant Jain, "Problem Solving in Data Structures & Algorithms using C++", CreateSpace Independent Publishing Platform (2017), ISBN 978-1542396479
2. G A V PAI, "DATA STRUCTURES and Algorithms Concepts, Techniques and Applications", McGraw Hill (2017), ISBN 978-0070667266
3. Michael T. Goodrich, Roberto Tamassia, David Mount, "Data Structures and Algorithms in C++ ", Wiley (2007), ISBN 978-8126512607
4. E Balagurusamy, "Object-Oriented Programming with C++", McGraw Hill Education; Seventh edition (2017), ISBN 978-9352607990

Home

Savitribai Phule Pune University, Pune
Second Year Artificial Intelligence & Machine Learning (2020 Course)
218547 : Object Oriented Programming Laboratory

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical (PR) : 04 hrs/week	02	PR: 25 Marks TW: 25 Marks

Prerequisites: Student should have knowledge of programming language.

Course Objectives:

1. Apply concepts of object-oriented paradigm.
2. Design and implement models for real life problems by using object-oriented programming.
3. Develop object-oriented programming skills.

Course Outcomes:

On completion of the course, students will be able to–

CO1: Differentiate various programming paradigms.

CO2: Identify classes, objects, methods, and handle object creation, initialization, and destruction to model real-world problems.

CO3: Identify relationship among objects using inheritance and polymorphism.

CO4: Handle different types of exceptions and perform generic programming.

CO5: Use file handling for real world application.

CO6: Apply appropriate design patterns to provide object-oriented solutions.

Guidelines for Instructor's Manual

The instructor‘s manual is to be developed as a hands-on resource and reference. The instructor's manual need to include prologue (about University/program/ institute/ department/foreword/ preface etc.), University syllabus, conduction & Assessment guidelines, topics under consideration concept, objectives, outcomes, set of typical applications/assignments/ guidelines, and references.

Guidelines for Student's Lab Journal

1. The laboratory assignments are to be submitted by student in the form of journal.
2. Journal consists of prologue, Certificate, table of contents, and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory- OOP feature/Concept in brief, algorithm, flowchart, test cases, conclusion/analysis.
3. Program codes with sample output of all performed assignments are to be submitted as hardcopy.
4. As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal may be avoided.
5. Use of DVD containing students programs maintained by lab In-charge is highly encouraged.
6. For reference one or two journals may be maintained with program prints at Laboratory.

Guidelines for Lab /TW Assessment
1. Continuous assessment of laboratory work is done based on overall performance and lab assignments performance of student. 2. Each lab assignment assessment will assign grade/marks based on parameters with appropriate weightage. 3. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness.
Guidelines for Practical Examination
Both internal and external examiners should jointly set problem statements. During practical assessment, the expert evaluator should give the maximum weightage to the satisfactory implementation of the problem statement. The supplementary and relevant questions may be asked at the time of evaluation to test the student‘s for advanced learning, understanding of the fundamentals, effective and efficient implementation. So encouraging efforts, transparent evaluation and fair approach of the evaluator will not create any uncertainty or doubt in the minds of the students.
Guidelines for Laboratory Conduction
The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy need to address the average students and inclusive of an element to attract and promote the intelligent students. The instructor may set multiple sets of assignments without changing its complexity level and distribute among batches of students. Encourage students for the use of industry coding standards such as appropriate use of Hungarian notation, Indentation and comments. Use of open source software is encouraged. Set of suggested assignment list is provided, instructors may take different case studies with similar complexity level. Operating System recommended :- 64-bit Open source Linux or its derivative Programming tools recommended: - JAVA IDE
List of Assignments
1.Classes and object -- CO1 and CO2
Design a class ‘Complex ‘with data members for real and imaginary part. Provide default and Parameterized constructors. Write a program to perform arithmetic operations of two complex numbers.
2. Polymorphism -- CO3
Identify commonalities and differences between Publication, Book and Magazine classes. Title, Price, Copies are common instance variables and saleCopy is common method. The differences are, Bookclass has author and orderCopies(). Magazine Class has methods orderQty, Current issue, receiveissue().Write a program to find how many copies of the given books are ordered and display total sale of publication.

3.Inheritance -- CO3
Design and develop inheritance for a given case study, identify objects and relationships and implement inheritance wherever applicable. Employee class hasEmp_name, Emp_id, Address, Mail_id, and Mobile_noas members. Inherit the classes: Programmer, Team Lead, Assistant Project Manager and Project Manager from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary.
4.Dynamic Binding -- CO3
Design a base class shape with two double type values and member functions to input the data and compute_area() for calculating area of shape. Derive two classes: triangle and rectangle. Make compute_area() as abstract function and redefine this function in the derived class to suit their requirements. Write a program that accepts dimensions of triangle/rectangle and display calculated area. Implement dynamic binding for given case study.
5.Interface -- CO1, CO3
Design and develop a context for given case study and implement an interface for Vehicles Consider the example of vehicles like bicycle, car and bike. All Vehicles have common functionalities such as Gear Change, Speed up and apply breaks. Make an interface and put all these common functionalities. Bicycle, Bike, Car classes should be implemented for all these functionalities in their own class in their own way.
6.Exception handling -- CO4
Implement a program to handle Arithmetic exception, Array Index Out of Bounds. The user enters two numbers Num1 and Num2. The division of Num1 and Num2 is displayed. If Num1 and Num2 are not integers, the program would throw a Number Format Exception. If Num2 were zero, the program would throw an Arithmetic Exception. Display the exception.
7.Template -- CO4
Implement a generic program using any collection class to count the number of elements in a collection that have a specific property such as even numbers, odd number, prime number and palindromes.
8.File Handling -- CO5
Implement a program for maintaining a database of student records using Files. Student has Student_id,name, Roll_no, Class, marks and address. Display the data for few students. 1. Create Database 2. Display Database 3. Delete Records 4. Update Record

5. Search Record

9.Case Study -- CO2, CO5

Using concepts of Object-Oriented programming develop solution for any one application

1) Banking system having following operations :

1. Create an account 2. Deposit money 3. Withdraw money 4. Honor daily withdrawal limit
5. Check the balance 6. Display Account information.

2) Inventory management system having following operations :

1. List of all products 2. Display individual product information 3. Purchase 4. Shipping
5. Balance stock6. Loss and Profit calculation.

10. Factory Design Pattern -- CO6

Implement Factory design pattern for the given context. Consider Car building process, which requires many steps from allocating accessories to final makeup. These steps should be written as methods and should be called while creating an instance of a specific car type. Hatchback, Sedan, SUV could be the subclasses of Car class. Car class and its subclasses, CarFactory and Test Factory Pattern should be implemented.

11. Strategy Design Pattern -- CO6

Implement and apply Strategy Design pattern for simple Shopping Cart where three payment strategies are used such as Credit Card, PayPal, Bit Coin. Create an interface for strategy pattern and give concrete implementation for payment.

Text Books:

1. E. Balagurusamy, “Programming with Java – A Primer”, Tata – McGraw-Hill Publication, 4th Edition, 2019
2. Kathy Sierra, “OCA /OCP Java SE 7 Programmer I & II Study Guide”(Exams 1Z0-803 & IZ-804) Oracle Press (2017)
3. Steven Holzner et al. “Java 2 Programming”, Black Book, Dreamtech Press, 2009

Reference Books:

1. H.M. Deitel, P.J. Deitel, “Java - How to Program”, PHI Publication, 6th Edition, 2005
2. Bruce Eckel, “Thinking in Java”, PHI Publication
3. Poo, Danny, Kiong, Derek, Ashok, Swarnalatha,“ Object-Oriented Programming and Java”, ISBN 978-1-84628-963-7
4. Erich Gamma,Richard Helm ,Ralph Johnson,JohnVlissides, “Design Patterns ,Elements of Reusable Object- Oriented Software” ISBN-13: 978-0201633610
5. RohitJoshi, “Java Design patterns, Reusable solutions to common problems” Java Code Geeks

Home

Savitribai Phule Pune University, Pune
Second Year Artificial Intelligence & Machine Learning (2020 Course)
218548 : Computer Networks Laboratory

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical (PR) : 02 hrs/week	01	PR : 25 Marks TW: 25 Marks

Prerequisite Courses, if any:

Course Objectives:

1. To design and implement small size network and to understand various networking commands.
2. To provide the knowledge of various networking tools and their related concepts.
3. To understand various application layer protocols for its implementation in client/server environment.
4. To understand network layer protocols and its implementations.
5. To explore and understand various simulations tools for network applications.

Course Outcomes:

On completion of the course, students will be able to–

CO1: Implement small size network and its use of various networking commands.
CO2: Understand and apply of networking and simulation tool i.e packet tracer.
CO3: Configure the various routing and switching protocols using packet tracer.
CO4: Configure various client/server environments to use application layer protocols.
CO5: Explore use of protocols in various wired applications.

Guidelines for Instructor's Manual

The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/Assistant.

The instructor's manual should include prologue, university syllabus, conduction & assessment guidelines, topics under consideration-concept, objectives, outcomes, networking diagrams in packet tracer, and rules to implement the protocols.

Guidelines for Student's Lab Journal

1. The laboratory assignments are to be submitted by students in the form of journals. The Journal consists of prologue, Certificate, table of contents, and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory-Concept, algorithms, printouts of the code written using coding standards, sample test cases etc.)
2. Practical Examination will be based on the term work.
3. Candidate is expected to know the theory involved in the experiment.
4. The practical examination should be conducted if the journal of the candidate is completed in all respects and certified by concerned faculty and head of the department.
5. All the assignment mentioned in the syllabus must be conducted.

Guidelines for Lab /TW Assessment
1. Examiners will assess the term work based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of handwritten write-up along with results of implemented assignment, attendance etc. 2. Examiners will judge the understanding of the practical performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried out.
Guidelines for Laboratory Conduction
The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The instructor may set multiple sets of assignments and distribute among batches of students. It is appreciated if the assignments are based on real world problems/applications. **All the assignments should be conducted on 64-bit open-source software like packet tracer, g++/turbo C++/Eclipse, Seventh assignment is for study only. Configure the application protocols on latest server operating system separately.**
Guidelines for Practical Examination
Both internal and external examiners should jointly set problem statements for practical examination. During practical assessment, the expert evaluator should give the maximum weightage to the satisfactory implementation of the problem statement. The supplementary and relevant questions may be asked at the time of evaluation to judge the student's understanding of the fundamentals, effective and efficient implementation. The evaluation should be done by both external and internal examiners.
List of Assignments
1. Network Commands on Linux/Windows - CO1
Explore and Study of TCP/IP utilities and Network Commands on Linux/Windows. i) Ping ii) ipconfig / ifconfig iii) Hostname iv) Whois v) Netstat vi) Route vii) Tracert/Traceroute/Tracepath viii) NSlookup ix) Arp x) Finger xi) Port Scan / nmap
2. Configuration of router using router commands and subnetting of network -CO2,CO3,CO5
Using a Network Simulator (e.g. packet tracer) Configure i) A router using router commands, ii) Sub-netting of a given network

3.Configuration of Static routing and Default routing - CO2,CO3,CO5
Using a Network Simulator (e.g. packet tracer) Configure i) Static Routing ii) Default Routing
4. Configuration of EIGRP,RIPv2,OSPF - CO2,CO3,CO5
Using a Network Simulator (e.g. packet tracer) Configure i) EIGRP – Explore Neighbor-ship Requirements and Conditions, its K Values Metrics Assignment and Calculation, ii) RIPv2 iii) OSPF – Explore Neighbor-ship Condition and Requirement, Neighbor-ship states, OSPF Metric Cost Calculation.
5. Configuration of NAT,ACL,VLAN,STP - CO2,CO3,CO5
Using a Network Simulator (e.g. packet tracer) Configure i) Network Address Translation: Static, Dynamic & PAT (Port Address Translation) ii) Access Control lists – Standard & Extended. iii) VLAN, Dynamic trunk protocol and spanning tree protocol.
6. Socket Programming - CO4,CO5
Socket Programming using C/C++/Java. i) TCP Client, TCP Server ii) UDP Client, UDP Server
7. Server Administration - CO4,CO5
Introduction to server administration (server administration commands and their applications) and configuration of any three of below Server: (Study/Demonstration Only) FTP, Web Server, DHCP, Telnet, Mail, DNS
Reference Books
1. Andrew S. Tanenbaum, David J. Wethrall, Computer Network, Pearson Education, ISBN: 978-0-13-212695-3. 2. Behrouz A. Forouzan, Data Communication and Networking, McGraw Hill Education, ISBN: 978-1-25-906475-3, 5th Edition. 3. Kurose Ross, Computer Networking: A Top Down Approach Featuring the Internet, Pearson Education, ISBN: 978-81-7758-878-1. 4. Mayank Dave, Computer Network, Cengage Learning, ISBN :978-81-315-0986-9.

Home

Savitribai Phule Pune University, Pune
Second Year Artificial Intelligence & Machine Learning (2020 Course)
218549: Humanities and Social Sciences

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Tutorial : 01 hrs/week	01	Term work : 25 marks

Course Objectives:

To enable the students to explore aspects of human society and to acquire the intellectual, communication skills and develop characteristics that encourages personal fulfillment, meaningful professional life and responsible citizenship.

1. To facilitate Holistic growth;
2. To Educate about Contemporary, National and International affairs;
3. To bring awareness about the responsibility towards society.
4. To give an insight about the emergence of Indian society and the relevance of Economics.

Course Outcomes:

On completion of the course, students will be able to–

CO1: Aware of the various issues concerning humans and society.
CO2: Aware about their responsibilities towards society.
CO3: Sensitized about broader issues regarding the social, cultural, economic and human aspects, involved in social changes.
CO4: Able to understand the nature of the individual and the relationship between self and thecommunity.
CO5: Able to understand major ideas, values, beliefs, and experiences that have shaped humanhistory and cultures.

COURSE CONTENTS

Preamble: As applied sciences, Engineering and Technology are meant to come up with effective solutions to social problems making it imperative that the present generation of engineers and technologists understand the society they live in. Studying the social sciences can provide individuals with crucial answers and observations that could certainly help in understanding of one's life which can alleviate social relations. A broad perspective of nationalistic thinking will provide the students with the ability to be socially conscientious, more resilient and open to building an inclusive society.

Experiencing real-life situations and complex scenarios that arise in each situation will help the budding professions to contribute their skills and knowledge to helping people improve and understand their behaviour or psychological processes. Understanding how the world works begins with an understanding of oneself and gaining hands-on experience and/or thinking about human values and ethics will help trigger a sense of responsibility among the students and lead them to finding effective solutions.

Course Structure: The tutorial sessions to be divided into 2 groups

1. Interactive Sessions to be conducted in classroom
2. Interactive Activities to be conducted Outside Classroom

MOOC/ Video Lectures available at$:

https://nptel.ac.in/courses/109/103/109103023/

https://nptel.ac.in/courses/109/107/109107131/

a) Teachers will play the role of interventionists and instigating students to apply their thinkingabilities on social concepts
b) As facilitators and mentors teachers will coax the students to thinking out-of-the-box to comeup with creative solutions
c) Teachers should focus on instilling a sense of social consciousness through the activities conducted indoors and outdoors.

Change of Mindset

a) Since the course deviates from technical subjects, students will have to be counseled into the importance of social sciences.
b) A background understanding of the importance of this course in their professional and personal life will have to be enumerated to the students.
c) Teachers will have to rationalize the course outcomes to get the students invested in the activities being conducted.

Designing of Course

a) Since students lack prior knowledge, it is imperative that the tutorials conducted be engaging in its activities.
b) Focus of the sessions should be the learning outcome of each activity conducted either in the class or outside the class.
c) All activities designed should be as close to real-life making them relatable and applicable.
d) Student-engagement should be a priority so that the knowledge internalized will be higher.
e) The activities chosen can be modified to cater to the college location and social context.
f) The learning should be focused on application of ethics and values during each activity.
g) The chosen sessions should cater to giving the students the opportunity to be involved and engaged in their role as contributors to society and the nation at large.

Basic function of the tutor

a) To present a holistic view of the curriculum and the role of this course in it and emphasizing the benefit of the sessions towards developing communications kills, critical thinking and problems solving.

Grouping

a) The class will be divided into groups of 20 students.
b) The blend of cultural and social diversity will enhance the learning at the end of each activity.
c) Teachers will have to be mentored to handle sensitive issues diplomatically while encouraging students to stand up for their beliefs.
d) The groups will have to have inter-personal sessions so that they get to understand their team members better and work cohesively.
e) Management support and encouragement to engage students in life-enriching experiences is important.

Assessment of Learning

a) It is important for tutors to make sure that assessment is consistent with learning objectives of each activity.
b) Assessment of students should be focused on the students' ability to internalize the learning.
c) Tutors need to understand meaningful ways of assessing students' work to motivate learning.

Tutorial Conduction and Term Work guidelines

Interactive Sessions to be conducted during Tutorial (in classroom)

1. PREPARED SPEECH ON CURRENT AFFAIRS

a) Purpose – Get students to stay abreast and invested in national current affairs.
b) Method – Each student has to read an editorial from any national paper (English), find out more information on the topic and present it to the class; ending the session with his/her opinion on the matter.
c) Outcome – Awareness of national state of affairs. Improve on oratory skills. Instil the thinking and contemplative skills and form non-judgmental opinions about an issue.

2. UNDERSTANDING INDIA'S CULTURAL DIVERSITY

a) Purpose – Expose students to the intricacies of Indian cultural across various states
b) Method – Each student (or a small group of students in case the number of students is large) has to pick a state and come to the tutorial session prepared with a PPT that will showcase the demographic, sociographic and cultural information of that state
c) Outcome – Information about the beauty of Indian cultural diversity. Enhance exploratory skill, communication skills and learn to present using technological tools.

3. WRITING AN ARTICLE ON ANY SOCIAL ISSUE

a) Purpose – Highlight various social and cultural evil malevolence existing in our country and express one's opinion on how it can be changed.
b) Method – Each student will have to write a 200 word essay on any of existing social malice that is prevalent in society. On evaluation, the top 5 essays can be displayed on the college wall magazine and rewarded if deemed appropriate.
c) Outcome – Learn to raise one's voice against the wrong doings in communities. Build writing skills, improve language and gain knowledge about how to write an impactful essay.

4. GROUP DISCUSSION ON COMMUNAL TOPIC

a) Purpose – Make students aware of the issues that are pertinent in a society and express a learned opinion about it.
b) Method – Students in groups of 20 each will discuss a relevant and grave issue that is dogging the nation. Alternatively, topics from current affairs (National budget, democratic process, economical strengthening of the country).
c) Outcome – Develop group communication skills. Learn to speak up one's opinion in a forum.

Cultivate the habit of presenting solution-driven arguments making them contributors in any team.

5. QUIZ ON SOCIAL BEHAVIOR

a) Purpose – Augment proper social etiquette among students and make them responsible citizens
b) Method – Conduct a quiz on traffic rules using audio-visual aids or using dumb charades where one student has to enact the traffic rule and the others have to guess that rule
c) Outcome – Grasp of various traffic rules and driving etiquette. Build verbal and non- verbal communication skills

6. SCREEN A MOVIE (FOCUS ON POSITIVITY AND POWER OF THE MIND)

a) Purpose – Expose students to introspective skills and try to develop a positive thinking in life.
b) Method – Screen a movie / a documentary / a video that focuses on the power of the mind and how to create affirmations in one's life. At the end of the movie, students can be asked to express their opinions and write down what changes / improvements they plan to take in their choices thereafter. This can be followed by a guest lecture by expert/s or workshop.
c) Outcome – Comprehend the areas of improvement within themselves. Understand the importance of staying positive and develop affirmations.

7. QUIZ ON SOCIAL BEHAVIOR

a) Purpose – Augment proper social etiquette among students and make them responsible citizens.
b) Method – Conduct a quiz on traffic rules using audio-visual aids or using dumb charades where one student has to enact the traffic rule and the others have to guess that rule.
c) Outcome – Grasp of various traffic rules and driving etiquette. Build verbal and non- verbal communication skills.

8. DEBATE ON A TOPIC FROM SOCIAL SCIENCES

a) Purpose – Educate students about various domains in social sciences and develop an interest towards gaining knowledge about these topics
b) Method – Various topics from various domains of social sciences can be chosen and students in pairs can pick a topic and present their arguments for or against the topic.
c) Time for each debate will be 10 minutes maximum
d) Outcome – Recognize the significance of social sciences in our lives. Cultivate the habit to present forceful arguments while respecting the opponents perspective and enhance verbal skills.

Interactive Activities to be conducted during Tutorial (Outside Classroom)

1. WASTE MANAGEMENT and CLEAN CAMPUS
   a) Purpose: Create awareness among students about the significance of a clean environment and social responsibility to deter littering and segregate waste.
   b) Method: Students (in groups) will be given charge of areas of campus and will be expected to clean that segment. Also, they will be entrusted with the responsibility to collect, separate waste and hand over to the housekeeping authority.
   c) Outcome: Develop the habit to maintain cleanliness at home as well as learn to respect community areas at college or workplace. It will also encourage them become ambassadors among their peers to advocate protection of the environment.

2. MAKING A VIDEO ON SOCIAL WASTAGES.

   a) Purpose: Instil among students a sense of responsibility towards judiciously using natural resources like water and electricity
   b) Method: Using their phones / hand-held devices, groups of students will make a 3 – 4 minute short film that will highlight irresponsible behavior in terms of wastage of water, leaving lights, fans and other electrical appliances on when not in use, defacing public and campus property by scribbling on walls and common areas. They will make awareness for the same among students. The creative videos will be posted on the college website and social media as an encouragement
   c) Outcome: Conscientious behavior towards saving public utility resources. Explore the use of audio-visual tools to create more meaningful messages that can effect a change in society

3. RELAY MARATHON (3 – 5 kms)

   a) Purpose: Propagate a social message by way of a sport activity
   b) Method: A group of students will begin the race with banner / placard in hand that contains a social message. The group runs for 500 meters and hands over the banner / placard to the next group of students. This chain of exchange will continue for 3 – 5 kms.
   c) Outcome: Become aware of the need for fitness and encouragement towards healthier lifestyle. Students will also be able to express their creativity in terms of meaningful messages and gain attention towards worthy social causes from the community in and around the campus.

4. TREE PLANTATION ON CAMPUS

   a) Purpose: Involve students to actively participate in environment protection and develop greener surroundings.
   b) Method: Each student will plant a sapling and take care of that plant until it is able to sustain itself. Alternatively, students can organize a tree plantation drive in a public area and nurture it.
   c) Outcome: Besides increase in plants in the locality, students will feel a sense of empowerment and become social contributors towards protecting the environment.

5. VISIT TO AN OLD AGE HOME / ORPHANAGE

a) Purpose: Build a sense of responsibility towards the less fortunate in our society and feel privileged to be able to effect real change in the world around us.
b) Method: Students have to visit an old age home or orphanage in the vicinity of the college. They can interact with the inmates, probably donate utilities to the charity organization and/or probably stage a few inclusive activities with the residents of the place. After the visit, students can submit a brief report about their experience.
c) Outcome: Learn first-hand about the conditions and social situations that the no-so-privileged members of our society have to endure to survive and go beyond their embarrassment to interact with the destitute which will help students appreciate the importance of Indian family values.

6. STREET PLAY ACTIVITY

a) Purpose: Create awareness in themselves as well as people in the community on various social evils that need to be eradicated
b) Method: Students will prepare and enact a street play on any pertinent issues in society. The topics suggested can be perils of mobile phones / online fraud / safety for girls / mental and physical health of the youth.
c) Outcome: Allow students to deliberate and think deeply about the looming issues that is dogging our society and the future of the youth. This will also bring out the creative skills among the students and allow them to showcase their talent.

7. BUDDY / BIG BROTHER SYSTEM

a) Purpose: Include and involve the less fortunate children making them feel wanted and cared for as well as use the opportunity to share knowledge among school students.
b) Method: Students have to go to nearby schools after procuring appropriate permissions to teach a particular topic on either technical or non-technical domains. Each student can choose to adopt 5 students from the class to be their mentor over a period of 1 year by staying in touch with them and helping them resolve their issues on academic or other matters.
c) Outcome: Appreciation and respect towards the responsibility of teaching. They will learn to be accountable as social contributors and bring about some change in the lives of the young students they mentor as Buddies or Big Brother.

Term Work Assessment Guidelines

Students must submit the report of all conducted activities. Conducted during Tutorial (Outside Classroom) of at least 04 activities (out of 07 activities) from group (of 02-03) students.

The brief guidelines for report preparations are as follows:

1. One activity report must be of maximum 3 pages;
2. Combined Report of all activities with cover pages, table of contents and certificate (signed by instructor) is to be submitted in soft copy (pdf) format only.
3. The report must contain:

- General information about the activity;
- Define the purpose of the activity;
- Detail out the activities carried out during the visit in chronological order;
- Summarize the operations / process (methods) during the activities;
- Describe what you learned (outcomes) during the activities as a student;
- Add photos of the activity;(optional)
- Add a title page to the beginning of your report;
- Write in clear and objective language; and
- Get well presented, timely and complete report submitted.

Recommended Assessment and Weightage Parameters:
(Attendance 30%, Assignments/Activities- Active participation and proactive learning 50% and report 20%)

Books:

1. A. Alavudeen, M. Jayakumaran, and R Kalil Rahman, "Professional Ethics and Human Values"
2. Ram Ahuja, "Social Problems in India" (third edition)
3. Shastry, T. S. N., "India and Human rights: Reflections", Concept Publishing Company India Pvt.Ltd., 2005.
4. Nirmal, C.J., "Human Rights in India: Historical, Social and Political Perspectives (Law in India)",Oxford India
5. Rangarajan, "Environmental Issues in India", Pearson Education.
6. University of Delhi, The Individual and Society, Pearson Education.
7. Wikipedia.org / wiki /social studies.
8. M. N. Srinivas, "Social change in modern India", 1991, Orient Longman.
9. David Mandelbaum, Society in India, 1990, Popular.

Dr. Abha Singh, "Behavioral Science: Achieving Behavioral Excellence for Success", Wiley.

e-books:

- https://www.moteoo.org/en/products/social-science-and-humanities-student-book-english
- https://www.springeropen.com/books
  (SpringerOpen open access books; download them free of charge from SpringerLink)
- https://muse.jhu.edu/article/541846/pdf
  (This content has been declared *free* to read by the publisher during the COVID-19)

Home

Savitribai Phule Pune University
Second Year Artificial Intelligence & Machine Learning (2020 Course)
218550 : Soft Skill Laboratory

Teaching Scheme:	Credit Scheme :	Examination Scheme:
Practical (PR) : 02 hrs/Week	01	TW : 25 Marks

Prerequisites , If any: ------

Course Objectives:

1. To facilitate a holistic development of students while focusing on enhancing soft skills.
2. To highlight the need to improve soft skills among engineering students so as to become good professionals.
3. To develop and nurture the soft skills of the students through individual and group activities.
4. To expose students to right attitudinal and behavioural aspects and assist in building the same through activities.

Course Outcomes:

On completion of the course, students will be able to–

CO1: Introspect about individual's goals, aspirations by evaluating one's SWOC and think creatively.

CO2: Develop effective communication skills including Listening, Reading, Writing and Speaking.

CO3: Constructively participate in group discussion, meetings and prepare and deliver Presentations.

CO4: Write precise briefs or reports and technical documents.

CO5: Practice professional etiquette, present oneself confidently and successfully handle personal interviews .

CO6: Function effectively in multi-disciplinary and heterogeneous teams through the knowledge of team work, Inter-personal relationships, conflict management and leadership quality.

COURSE CONTENTS

Unit I	Introspective & Self Development	04 hrs

Introduction to soft skills, SWOC analysis, planning career, setting short-term & long-term goals, identifying difference between jobs & career, aligning aspirations with individual skills, understanding self-esteem, developing discipline and critically evaluating oneself

Mapping of Course Outcomes for Unit I	CO1, CO6	
Unit II	**Communication Skills**	**04 hrs**

Essentiality of good communication skills, importance of feedback, different types of communication, barriers in communication and how to overcome these barriers, significance of non-verbal messages as augmentation to verbal communication, group discussion, listening vs hearing, reading to comprehend, learning to skim and scan to extract relevant information, effective digital communication

Mapping of Course Outcomes for Unit II	**CO2, CO3, CO5**	
Unit III	**Language and Writing Skills**	**04 hrs**
Fundamentals of english grammar, improve lexical resource, essential steps to improve spoken and written english, business vocabulary, writing – email, resume, formal letter, official communication, essay, presentation – planning, organizing, preparing and delivering professional presentation		
Mapping of Course Outcomes for Unit III	**CO2, CO4**	
Unit IV	**Leadership Skills and Group Dynamics**	**04 hrs**
Understanding corporate culture and leadership skills, difference between a leader and a manager, importance of resilience in a professional surrounding, developing empathy and emotional intelligence, being assertive and confident, 4-Ds of decision making, creative and solution-centric thinking, resolving conflicts, working cohesively as a team to achieve success, five qualities of an effective team – positivity, respect for others, trust, goal-focused, supportiveness		
Mapping of Course Outcomes for Unit IV	**CO1, CO5, CO6**	
Unit V	**Ethics, Professional Etiquette**	**04 hrs**
Understanding ethics and morals, importance of professional ethics, hindrances due to absence of work ethics, professional etiquette – introductions, with colleagues, attire, events, dinning, telephone, travelling, netiquette, social media, writing		
Mapping of Course Outcomes for Unit V	**CO5, CO6**	
Unit VI	**Stress And Time Management**	**04 hrs**
Stress as integral part of life, identifying signs and sources of stress, steps to cope with stress – open communication, positive thinking, belief in oneself, ability to handle failure, retrospective thinking for future learning, organizing skills to enhance time management, focusing on goals, smart work vs hard work, prioritizing activities, perils of procrastination, daily evaluation of "to-do" list.		
Mapping of Course Outcomes for Unit VI	**CO1, CO3, CO6**	
Text Book :		
1. Gajendra Singh Chauhan, Sangeeta Sharma,"Soft Skills – An Integrated Approach to Maximize Personality", WILEY INDIA, ISBN:13:9788126556397		
Reference Books :		
1. Indrajit Bhattacharya, "An Approach to Communication Skills", Delhi, DhanpatRai, 2008 2. Simon Sweeney, "English for Business Communication", Cambridge University Press, ISBN 13:978-0521754507 3. Sanjay Kumar and Pushpa Lata, "Communication Skills", Oxford University Press, ISBN 10:9780199457069		

4. Atkinson and Hilgard, "Introduction to Psychology", 14th Edition, Geoffrey Loftus, ISBN-10:0155050699, 2003
5. Kenneth G. Mcgee, "Heads Up: How to Anticipate Business Surprises & Seize Opportunities First", Harvard Business School Press, Boston, Massachusetts, 2004, ISBN 10:1591392993
6. Krishnaswami, N. and Sriraman T., "Creative English for Communication" , Macmillan

Guidelines for Student's Lab Journal and TW Assessment

Each student should have a Lab Workbook (sample workbook attached) which outlines each lab activity conducted. The student must respond by writing out their learning outcomes and elaborating the activities performed in the lab. Continuous assessment of laboratory work is to be done based on overall performance and lab assignments and performance of student. Each lab assignment assessment will be assigned grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, punctuality, neatness, enthusiasm, participation and contribution in various activities-SWOC analysis, presentations, team activity, event management, group discussion, group exercises and interpersonal skills and similar other activities/assignments.

Guidelines for Conduction of Soft Skills Lab

The teacher may design specific assignments that can highlight the learning outcomes of each unit. Each activity conducted in the lab should begin with a brief introduction of the topic, purpose of the activity from a professional point of view and end with the learning outcomes as feedback from students. Most of the lab sessions can be designed to be inclusive; allowing students to learn skills experientially; which will benefit them in the professional environment. Every student must be given sufficient opportunity to participate in each activity and constructive feedback from the instructor / facilitator at the end of the activity should learn towards encouraging students to work on improving their skills. Activities should be designed to respect cultural, emotional and social standing of students. Some of the activities can be designed to cater to enhancement of multiple skills – For e.g. – Team Building Activity can highlight 'open communication', 'group discussion', 'respecting perspectives', 'leadership skills', 'focus on goals' which can help students improve their inherent interpersonal skills.

At least one session should be dedicated to an interactive session that will be delivered by an expert from the industry; giving the students an exposure to professional expectations.

Virtual Laboratory

- https://ve-iitg.vlabs.ac.in/

Recommended List of Lab Sessions

1. Introduction of Self / SWOC Analysis -- CO1, CO4

a. Explain how to introduce oneself in a professional manner and presenting oneself positively Name, Academic Profile, Achievements, Career Aspirations, Personal Information (hobbies, family, social).

b. Focus on introspection and become aware of one's Strengths, Weakness, Opportunities and Challenges.

Students can write down their SWOC in a matrix and the teacher can discuss the gist personally.

2. Career Goals and Planning -- CO1, CO4

a. Make students understand the difference between a job and a career. Elaborate steps on how to plan a career.
Students can choose a career and they should write down what skills, knowledge, steps are need
to be successful in that particular career and how they can get the right opportunity.

b. Explain to students how to plan short term and long term goals.
Think and write down their short-term goals and long terms goals. Teacher can read and discuss (provide basic counselling) about the choices written.

3. Public Speaking -- (Choose any 2) -- CO3, CO2

a. Prepared Speech
Topics will be shared with students and they will be given 10 minutes to prepare and 3 minutes to deliver followed by Q&A from audience. Teacher will evaluate each student based on content, communication skills, logical and cohesive presentation of topic, perspective of student, ability to handle questions and respond positively.

b. Extempore Speech
Various topics will be laid out in front of the audience and each student is to pick one topic and speak about the topic for 5 minutes followed by Q&A from audience. Teacher will evaluate each student based on ability to think on his/her feet, content, communication skills, logical and cohesive presentation of topic, perspective of student, ability to handle questions and respond positively.

c. Reviewing an Editorial article
Either using e-paper / printed copy, students have to select a recent editorial (that is non-controversial), read it and explain to the audience what the editor's perspective is and what the student's perspective is.

d. Book Review
Each student will orally present to the audience his/her review of a book that he/she has recently read.

4. Group Discussion -- CO3, CO2

a. The class will be divided into groups of 8 – 10 students in for a discussion lasting 10 minutes.

b. Topics should be topical and non-controversial. After each group finishes its discussion, the teacher will give critical feedback including areas of improvement. The teacher should act as a moderator / observer only

5. Listening and Reading Skills -- CO2

a. Listening Worksheets to be distributed among students
Each student will be given specifically designed worksheets that contain blanks / matching / MCQs that are designed to an audio (chosen by the faculty). Students have to listen to the audio (only once) and complete the worksheet as the audio plays. This will help reiterate active listening as well as deriving information (listening to information between the lines)

b. Reading Comprehension Worksheets to be distributed/displayed to students
Teacher will choose reading passages from non-technical domains, design worksheets with questions for students to answer. This will enhance student's reading skills by learning how to skim and scan for information.

6. Writing Skills (Choose any 2) -- CO2

a. Letter / Email Writing

After explaining to the students the highlights of effective writing, students can be asked to write (using digital platforms / paper-based) letter to an organization with the following subject matter,

- **i.** Requesting opportunity to present his/her product.
- **ii.** Complaining about a faulty product / service.
- **iii.** Apologizing on behalf of one's team for the error that occurred.
- **iv.** Providing explanation for a false accusation by a client.

b. Report Writing

After describing various formats to write report and explaining how to write a report, each student should be asked to write a report (digital/ paper-based) on any of the following topics,

- **i.** Industrial visit.
- **ii.** Project participated in.
- **iii.** Business / Research Proposal.

c. Resume Writing

The teacher should conduct a brief session outlining the importance of a CV / Resume and students can write / type out their own resumes

- **i.** Share various professional formats.
- **ii.** Focus on highlighting individual strengths.
- **iii.** Develop personalized professional goals / statement at the beginning of the resume.

7. Team Building Activities -- CO3, CO4

The class will be divided into groups of 4-5 students in each group and an activity will be given to each group.

The activities chosen for each team should be competitive and should involve every student in the team. The activities may be conducted indoors or outdoors depending on infrastructure. While selecting the team, ensure that each team has a mix of students who have varied skills. The teacher should give critical feedback including areas of improvement at the end of the activity.

8. Expert Lecture -- CO4

Highlighting the need to manage stress and time, experts from the fields of health and fitness, counselling, training, medical or corporate HR may be invited to deliver a participatory session that focus on helping students to cope with parental, social, peer and career pressures.

9. Lateral and Creative Thinking -- CO1, CO4

Every student needs to step out of the linear thinking and develop lateral and creative thinking. Teacher can develop creative activities in the classroom / lab that will help students enhance their creative thinking. Some of the suggested activities,

- **i.** Each group (3-4 students) can be given random unrelated items and they will be given sufficient time to come up with creative ideas on how the objects can be used for activities / purposes other than its intended one.
- **ii.** Each student is given a random line and he/she has to spin a fictional story and tell it to the class (3 minutes). Each story should have a beginning, middle and end.
- **iii.** Each group (3-4 students) can be given a fictional / hypothetical dangerous situation and they have to find a solution to that problem. They can present it to the other teams who will then get the opportunity to pick flaws in the ideas.

10. Mock Interviews -- CO2, CO3

Student has to undergo interview session and the teacher should seek the assistance of another faculty member / TPO Officer/ Alumni to act as interview panel. Students will be informed

beforehand about the job profile that they are appearing the interview for and they have to come prepared with a printed copy of their resume, formally dressed. Questions will include technical as well as HR. Interviewer can choose to give problems to solve using technical skills. Students will be graded on the basis of their technical knowledge, ability to answer questions well, presentation of self, body language and verbal skills.
11. Presentation Skills -- CO2, CO3
Every student will have to choose a topic of his/her choice and make a 5-minute presentation using audio-video aids / PPT. The topic can either be technical or non-technical. Focus and evaluation of each presentation should be the depth of knowledge about the topic, originality of perspective on the topic, well-researched or not, verbal and non-verbal skills and ability to answer questions effectively. Plagiarism should be discredit and students should be instructed about it.
12. Corporate and Business Etiquette -- CO4, CO1
The teacher can design an interactive session that allows students to be involved in understanding the requirements of a corporate environment. This can be done using innovative quiz competition in the classroom and the teacher explaining the concept / relevance of that particular aspect in the professional context. Alternatively, the teacher can invite professionals to have an interactive session with students about various aspects of professional etiquette.

Home

Savitribai Phule Pune University, Pune
Second Year Artificial Intelligence & Machine Learning (2020 Course)
218551 (A): Mandatory Audit Course 3:
Ethics and Values in Information Technology

Teaching Scheme:	Credit Scheme:	Examination Scheme:
01hrs/week	Non Credit	Audit Course

Prerequisite Courses, if any:--

Course Objectives:

1. To understand and implement the values and principles in the field of Information Technology.
2. To nurture honest and responsible professionals in Information Technology.
3. To develop student's understanding about social/ professional ethical issues related to Information Technology.
4. To inculcate professional ethics in the field of IT.

Course Outcomes:

On completion of this course students will be able to-

CO1: Adapt the global ethical principles and modern ethical issues.
CO2: Apprehend ethics in the business relationships and practices of IT.
CO3: Implement trustworthy computing to manage risk and security vulnerabilities.
CO4: Analyse concerns of privacy, privacy rights in information-gathering practices in IT.

COURSE CONTENTS

Unit -I	An Overview of Ethics	03hrs

An overview of Ethics: Brief about ethics, Ethics in the Business World, Ethics in IT.

Ethics for IT professionals and IT users: **IT professionals:** Changing Professional Services, Professional Relationships, Codes of Ethics, awareness of IT malpractices, **IT Users:** Common Ethical Issues for IT Users, Supporting the Ethical Practices of IT Users.

Mapping of Course Outcomes for Unit I	CO1 , CO2

Unit- II	Computer And Internet Crime	03hrs

Introduction: IT security incidents, Types of Exploits, Types of Perpetrators, Laws for Prosecuting Computer Attacks, Implementing Trustworthy Computing, Risk and Vulnerability Assessment, Educating Employees, Contractors, and Part-Time Workers, Establishing a Security Policy

Privacy: The right of Privacy, Privacy Protection and the Law, Key Privacy and Anonymity Issues Identity Theft, Consumer Profiling, Treating Consumer Data Responsibility, Workplace Monitoring

Freedom of Expression: Defamation and Hate Speech, Key issues, Controlling Access to Information on the Internet, Anonymity on the Internet, Corporate Blogging, Pornography

Mapping of Course Outcomes for Unit II	CO3, CO4

Unit- III	**Social Networking &Ethics of IT Organization**	**03 hrs**
Social Networking: Brief about Social Networking, **Social Networking Ethical Issues***:* Cyber bullying, Cyber stalking, Encounters with Sexual Predators, Uploading of Inappropriate Material, **Online Virtual Worlds**: Crime in Virtual Worlds, Educational and Business Uses of Virtual Worlds. **Ethics of IT Organization:** Key Ethical Issues for Organizations, of Workers, Outsourcing, Whistle-blowing, Code of Ethics and Professional Conduct.		
Mapping of Course Outcomes for Unit III	**CO2, CO3, CO4**	
Unit - IV	**Case Study**	**03hrs**
Malware, Medical Implants, Abusive Workplace Behaviour, Automated Active Response Weaponry, Malicious Inputs to Content Filters.		
Mapping of Course Outcomes for Unit IV	**CO1, CO2, CO3, CO4**	

Text Books:

1. George Reynolds,"Ethics in Information Technology", Cengage learning, 5th Edition
2. R. Subramanian, "Professional Ethics", OXFORD University Press, Second Edition

Reference Books:

1. William Lillie,"An Introduction to Ethics", Allied Publishers
2. Charles b. Fleddermann, "Engineering Ethics", Prentice Hall
3. M.Govindarajan,S.Natarajan&V.S.Senthilkumar, "Engineering Ethics &Human Values", PHI Learning
4. "ACM Code of Ethics and Professional Conduct Case Studies" **https://www.acm.org/code-of-ethics/case-studies**
5. "Case Studies of Ethics", **https://flylib.com/books/en/4.269.1.115/1/**
6. "UNODC Case Studies" **https://www.unodc.org/e4j/en/integrity-ethics/module-12/exercises/case-studies.html**

Evaluation :

Students should select any one of the topic in a group of 3 to 5. Students should submit a written report and make a presentation on the topic. The task should not be repeated among students. Report will be evaluated by the faculty as per rubrics defined by him/her/them at start of course.

Home

Savitribai Phule Pune University, Pune
Second Year Artificial Intelligence & Machine Learning (2020 Course)
218551 (B) : Mandatory Audit Course3:
Quantitative Aptitude & Logical Reasoning

Teaching Scheme:	Credit Scheme:	Examination Scheme:
01hrs/week	Non Credit	Audit Course

Prerequisite Courses, if any:--

Course Objectives:

1. To develop the quantitative, logical and verbal abilities.
2. To enable learners to interpret the data accurately.
3. To build logical thinking ability among the learners.
4. To enable students to comprehend the English text.

Course Outcomes:

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

CO1: Apply basic concepts of quantitative abilities

CO2: Use logical reasoning for solving real world problems

CO3: Compete in examinations like internships, industry placements, postgraduate admissions, civil services etc.

COURSE CONTENTS

Unit I	Fundamental Quantitative Abilities	03 hrs
Concepts and Problems on Number System, HCF and LCM, Average, Ratio and Proportion, Percentage, Year month days counting, SI units and measurements		
Mapping of Course Outcomes for Unit I	**CO1, CO2, CO3**	
Unit II	**Arithmetic Quantitative Abilities**	**02 hrs**
Concepts and Problems on Ages, Profit and loss, Simple and Compound interest, Time value of money, Time and distance, Time and Work, Geometry and Coordinate Geometry, logarithms		
Mapping of Course Outcomes for Unit II	**CO1, CO2, CO3**	
Unit III	**Logical Reasoning Ability**	**02 hrs**
Number Series, Pattern recognition, Alpha Numerical, Letter & Symbol Series , Numerical and Alphabet Puzzles, Seating Arrangement		
Mapping of Course Outcomes for Unit III	**CO2,CO3**	
Unit IV	**Thinking and Reasoning**	**02 hrs**

Objective Reasoning, Graph and Plots, Data sufficiency, Blood Relation, Coding deductive logic, Logical word sequence		
Mapping of Course Outcomes for Unit IV	**CO2, CO3**	
Unit V	**Verbal Ability**	**03 hrs**
Synonyms, Antonyms, Contextual Vocabulary, Error Identification, Sentence Correction, Sentence Improvement, Subject-Verb agreement, Tenses and Articles, Reading Comprehension, Preposition & Conjunction		
Mapping of Course Outcomes for Unit V	**CO1, CO2, CO3**	

Text Books:

1. Quantitative abilities by Arun Sharma, Motilal Uk Books of India, 2012
2. Quantitative Aptitude for Competitive Examinations by R S Agrawal
3. Verbal and Non-Verbal reasoning by R S Agrawal

Evaluation :

Students should select any one of the topic in a group of 3 to 5. Students should submit a written report and make a presentation on the topic. The task should not be repeated among students. Report will be evaluated by the faculty as per rubrics defined by him/her/them at start of course.

Home

Savitribai Phule Pune University, Pune
Second Year Artificial Intelligence & Machine Learning (2020 Course)
218551 (C) : Mandatory Audit Course 3:
Language Study Japanese -Module I

Teaching Scheme:	Credit Scheme:	Examination Scheme:
01hrs/week	Non Credit	Audit Course

Prerequisite Courses, if any: Audit Course 4: Language Study Japanese: Module-II

Course Objectives:

1. To teach pronunciation and intonation of Japanese sounds.
2. To enable students to comprehend and speak simple sentences in Japanese.
3. To introduce Japanese language at the basic level, to enable students to read and write the phonetic scripts, *Hiragana* and *Katakana,* and approx.100 *Kanji.,*
4. To teach some aspects of Japanese society and culture.

Course Outcomes:

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

CO1: Converse with simple sentences in Japanese.
CO2: Recognize and read simple sentences in Japanese.
CO3: Write simple sentences in Japanese.
CO4: Be aware about Japanese society and people.

COURSE CONTENTS

Unit I	Japanese Oral Expression	(02 hrs + 04 hrs Self Study)

Oral practice of pronunciation and intonation of Japanese sounds, Japanese greetings, self-introduction, identifying things, time of the day, calendar; counting using Japanese numerical classifiers; describing things; making comparisons; talking of daily activities, kinship terms used for address and reference, seasons, giving and receiving, shopping; making requests, talking of one's likes and dislikes

Mapping of Course Outcomes for Unit I	CO1

Unit II	Japanese Kana and Kanji	(02 hrs + 04 hrs Self Study)

Introduction of the Japanese writing system, i.e. *Hiragana*, *Katakana* and *Kanji* (100-120), word-building, writing foreign names and loan words in Katakana

Mapping of Course Outcomes for Unit II	CO2, CO3

Unit III	Japanese Greetings	(02 hrs + 04 hrs Self Study)

Basic sentence patterns to be applied in self-introduction, identifying things; time of the day; calendar; counting using Japanese numerical classifiers; describing things; making comparisons;

talking of daily activities; kinship terms used for address and reference; seasons; giving and receiving; shopping; making requests; talking of one's likes and dislikes		
Mapping of Course Outcomes for Unit III	**CO1**	
Unit IV	**Japanese Comprehension**	**(02 hrs+ 04 hrs Self Study)**
Extensive practice of basic patterns at the elementary level through drills and exercises		
Mapping of Course Outcomes for Unit IV	**CO1, CO2**	
Unit V	**Speaking Japanese**	**(02 hrs + 4 hrs Self Study)**
Simple conversation in situations such as describing things, making comparisons, talking of daily activities, giving and receiving of gifts, talking of illnesses and visit to a doctor, shopping, making requests, talking of one's likes and dislikes, talking on telephone etc.		
Mapping of Course Outcomes for Unit V	**CO1**	
Unit VI	**Social Environment of Japan**	**(02 hrs + 4 hrs Self Study)**
An introduction to some aspects of Japanese culture such as festivals, Japanese seasons, Japanese people and their love for nature; Japanese food, sports; society; geography; education system; Japan and the world etc. The objective is to create general awareness in students about life in Japan.		
Mapping of Course Outcomes for Unit VI	**CO4**	

E-Resources for Learning Support:

a. https://www.duolingo.com/course/ja/en/Learn-Japanese
b. https://www.freejapaneselessons.com/
c. https://minato-jf.jp/ **(Japan Foundation)**

Text Books:

1. Taeko Kamiya, Japanese For Fun Phrasebook & Dictionary: The Easy Way to Learn Japanese Quickly, Rev Edition 2017 Tuttle Publishing, (ISBN 10- 4805313986, ISBN 13 -9784805313985)
2. Eri Banno, Genki I: An Integrated Course in Elementary Japanese , 3rd Edition 2020, The Japan Times, (ISBN13: 9784789017305)
3. Sushama Jain, Japan : The Living Culture, Har-anand Publications, 2009, (ISBN 10: 8124114870 / ISBN 13: 9788124114872)

Reference Books:

1. Kanji Power Handbook for the Japanese Language Proficiency Test, 1994, ARC Press (ISBN: 9784872343144)
2. Yukiko Ogata, Kana Sumitani, Yasuko Hidari, Yukiko Watanabe, Nihongo fun and Easy -I Survival Japanese Conversation for Beginners,
3. Eriko Sato, Japanese Demystified: A Self-Teaching Guide, 2008, McGraw-Hill Companies, McGraw-Hill Demystified Series (ISBN 10-0071477268, ISBN 13-9780071477260)

Evaluation :

Students should select any one of the topic in a group of 3 to 5. Students should submit a written report and make a presentation on the topic. The task should not be repeated among students.

Report will be evaluated by the faculty as per rubrics defined by him/her/them at start of course.

Home

Savitribai Phule Pune University, Pune
Second Year Artificial Intelligence & Machine Learning (2020 Course)
218551 (D) : Mandatory Audit Course 3:
Cyber Security and Law

Teaching Scheme:	Credit Scheme:	Examination Scheme:
01hrs/week	Non Credit	Audit Course

Prerequisite Courses, if any: Basics of Computer

Course Objectives:

1. Understand basics of computer and cyber security.
2. To study the information technology law.
3. To understand reasons for cybercrime.
4. To learn investigation techniques.

Course Outcomes:

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

CO1: Understand the basic concepts of cyber security and its abilities
CO2: Analyse and evaluate the cyber security needs of an organization.
CO3: Understand the importance of cyber laws and its practices.
CO4: Determine and analyse software vulnerabilities and security solutions to reduce the risk of exploitation

COURSE CONTENTS

Unit I	Basics of Cyber Security	04 hrs

Information Security Definition and Concepts, Overview of Security Threats , Goals of Security, , Limitations and Challenges in cyber security , Types of Security attacks, Network Security, Malicious Codes, Intrusion detection systems, Hacking Techniques, Password cracking , Insecure Network Connections ,Concept of Firewall and Security.

Mapping of Course Outcomes for Unit I	CO1, CO2

Unit II	Cyber Laws	04 hrs

Introduction, Definition and origin, Cybercrime and Information security, Classification of Cybercrimes, The legal perspectives- Indian perspective- IT Act 2000, Global perspective, Categories of Cybercrime, Reasonable Security Practices

Mapping of Course Outcomes for Unit II	CO2, CO3, CO4

Unit III	Cyber Crime	04 hrs

Definition of Cyber Crime & Computer related Crimes, Classification &Differentiation between traditional crime and cybercrimes, Data Theft, Hacking, Spreading Virus &Worms, Phishing, Cyber

Stalking/ Bullying, Identity Theft &Impersonation, Credit card & Online Banking Frauds , Denial of Service Attacks , Cyber terrorism etc.. , Search and Seizure Procedures of Digital Evidence- Data Acquisition ,Data Analysis, Reporting, Cybercrime Scenario in India	
Mapping of Course Outcomes for Unit III	**CO2, CO3, CO4**

Text Books:

1. William Stallings, “Computer Security: Principles and Practices”, Pearson 6th Ed, ISBN: 978-0-13-335469-0
2. Nina Godbole, Sunit Belapure, “Cyber Security- Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, Wiley India Pvt.Ltd, ISBN- 978-81-265-2179-1
3. Nina Godbole , “Information Systems Security” , Wiley India Pvt. Ltd, ISBN -978-81-265-1692-6
4. Mark Merkow, “Information Security-Principles and Practices”, Pearson Ed., ISBN- 978-81-317-1288-7
5. Bernard Menezes, “Network Security and Cryptography”, Cengage Learning, ISBN-978-81-315-1349-1
6. “The Information Technology Act, 2000; Bare Act” – Professional Book Publishers

Evaluation :

Students should select any one of the topic in a group of 3 to 5. Students should submit a written report and make a presentation on the topic. The task should not be repeated among students. Report will be evaluated by the faculty as per rubrics defined by him/her/them at start of course.

SEMESTER – IV

Home

Savitribai Phule Pune University, Pune
Second Year Artificial Intelligence & Machine Learning (2020 Course)
207003 : Applied Mathematics

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory (TH) : 03 hrs/week	03	Mid_Semester: 30 Marks End_Semester: 70 Marks

Prerequisites: Differential & Integral calculus, Taylor series, Differential equations of first order and first degree, Fourier series, Collection, Classification and Representation of data.

Course Objectives:

1. To make the students familiarize with concepts and techniques in Linear differential equations, Fourier transform& Z-transform, Statistical methods, Probability theory and Numerical methods.2. The aim is to equip them with the techniques to understand advanced level mathematics and its applications that would enhance thinking power, useful in their disciplines.

Course Outcomes:

On completion of this course student will be able to –

CO1: Solve Linear differential equations, essential in modelling and design of computer-based systems.

CO2: Apply concept of Fourier transform and Z-transform and its applications to continuous and discrete systems and image processing.

CO3: Apply Statistical methods like correlation& regression analysis and probability theory for data analysis and predictions in machine learning.

CO4: Solve Algebraic &Transcendental equations and System of linear equations using numerical techniques.

CO5: Obtain Interpolating polynomials, numerical differentiation and integration, numerical solutions of ordinary differential equations used in modern scientific computing.

COURSE CONTENTS

Unit I	Linear Differential Equations	06 hrs

LDE of n^{th} order with constant coefficients, Complementary function, Particular integral, General method, Short methods, Method of variation of parameters, Cauchy's & Legendre's DE, Simultaneous & Symmetric simultaneous DE.

Unit II	Transforms	06 hrs

Fourier Transform (FT): Complex exponential form of Fourier series, Fourier integral theorem, Fourier Sine & Cosine integrals, Fourier transform, Fourier Sine & Cosine transforms and their inverses, Discrete Fourier Transform.

Z –Transform(ZT): Introduction, Definition, Standard properties, ZT of standard sequences and their inverses. Solution of difference equations.

Unit III	Statistics	06 hrs

Measures of central tendency, Measures of dispersion, Coefficient of variation, Moments, Skewness and Kurtosis, Curve fitting: fitting of straight line, parabola and related curves, Correlation and Regression, Reliability of Regression Estimates.

Unit IV	**Probability and Probability Distributions**	**06 hrs**

Probability, Theorems on Probability, Bayes theorem, Random variables, Mathematical Expectation, Probability density function, Probability distributions: Binomial, Poisson, Normal and Hyper geometric, Sampling distributions, Test of Hypothesis: Chi-Square test, t-test.

Unit V	**Numerical Methods**	**06 hrs**

Numerical Solution of Algebraic and Transcendental equations: Bisection, Secant, Regula-Falsi, Newton–Raphson and Successive Approximation Methods, Convergence and Stability.
Numerical Solutions of System of linear equations: Gauss elimination, LU Decomposition, Cholesky, Jacobi and Gauss-Seidel Methods.

Unit VI	**Numerical Methods**	**06hrs**

Interpolation: Finite Differences, Newton's and Lagrange's Interpolation formulae, Numerical Differentiation. Numerical Integration: Trapezoidal and Simpson's rules, Bound of truncation error. Solution of Ordinary differential equations: Euler's, Modified Euler's, Runge-Kutta 4^{th} order methods and Predictor-Corrector methods

Text Books:

1. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw-Hill
2. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publication, Delhi

Reference Books:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 10ed, Wiley India
2. M. D. Greenberg, "Advanced Engineering Mathematics", 2edPearson Education
3. Peter V. O'Neil , "Advanced Engineering Mathematics", 7ed,Cengage Learning
4. S. L. Ross , "Differential Equations", 3e, Wiley India
5. Sheldon M. Ross, "Introduction to Probability and Statistics for Engineers and Scientists", 5e, Elsevier Academic Press
6. M. K. Jain, S. R. K. Iyengar And R. K. Jain1, "Numerical Methods for Scientific and Engineering Computation", 5e,New Age International Publication

Home

Savitribai Phule Pune University, Pune
Second Year Artificial Intelligence & Machine Learning (2020 Course)
218552 : Operating Systems

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory (TH) : 3 hrs/week	3	Mid_Semester : 30 Marks End_Semester : 70 Marks

Prerequisite Courses, if any:

1. Computer Organization and Architecture.
2. Fundamentals of Data Structures.

Companion Course, if any:

Course Objectives:

1. To introduce basic concepts and functions of modern operating systems.
2. To understand the concept of process, thread management and scheduling.
3. To understand the concept of concurrency control.
4. To understand various Memory Management techniques.
5. To understand the concept of I/O and File management.
6. To understand different system software's like Assembler, Compiler, Macro-processor and Loaders / Linkers.

Course Outcomes:

On completion of the course, students will be able to –

CO1: Describe the role of Modern Operating Systems and **make use of** shell commands to **build** shell scripts.

CO2: Describe the concept of thread and process management, **compare** different process scheduling algorithms, and **justify** what algorithm to use in given scenario.

CO3: Explain synchronization and deadlock; **analyze** classical IPC problems, also **infer** the existence of deadlock in the system.

CO4: Apply the concepts of various memory management techniques.

CO5: Make use of concept of I/O management and File system.

CO6: Understand the concepts of different system softwares.

COURSE CONTENTS

Unit I	OVERVIEW OF OPERATING SYSTEM	(6 hrs)

Operating System Objectives and Functions, The Evolution of Operating Systems, Developments leading to Modern Operating Systems, Virtual Machines. Introduction to Linux OS, BASH Shell Scripting: Basic shell commands.

Mapping of Course Outcomes for Unit I	CO1

Unit II	PROCESS MANAGEMENT	(7 hrs)

Process: Concept of a Process, Process States, Process Description, Process Control.
Threads: Processes and Threads, Concept of Multithreading, Types of Threads, Thread programming Using Pthreads.
Scheduling: Types of Scheduling, Scheduling Algorithms (FCFS, SJF, Priority, RR).

Case Study: Process and Thread Management under Windows 8 versus Linux.

Mapping of Course Outcomes for Unit II	**CO2**

Unit III	**CONCURRENCY CONTROL**	**(7 hrs)**

Process/thread Synchronization and Mutual Exclusion: Principles of Concurrency, Requirements for Mutual Exclusion, Mutual Exclusion: Operating System Support (Semaphores and Mutex).
Classical synchronization problems: Readers/Writers Problem, Producer and Consumer problem, Inter-process communication (Pipes, Shared Memory).
Deadlock: Principles of Deadlock, Deadlock Modeling and Strategies to deal with deadlock: Prevention, Avoidance, Detection and Recovery. Example: Dining Philosophers Problem / Banker's Algorithm.
Case Study: Linux Inter Process communication.

Mapping of Course Outcomes for Unit III	**CO3**

Unit IV	**MEMORY MANAGEMENT**	**(6 hrs)**

Memory Management: Memory Management Requirements, Memory Partitioning: Fixed Partitioning, Dynamic Partitioning, Buddy System, Relocation, Paging, Page table structure, Segmentation.
Virtual Memory: Background, Demand Paging, Page Replacement (FIFO, LRU, Optimal), Allocation of frames, Thrashing.
Case Study: Linux Memory Management versus Windows Memory Management.

Mapping of Course Outcomes for Unit IV	**CO4**

Unit V	**INPUT/OUTPUT AND FILE MANAGEMENT**	**(6 hrs)**

I/O Management and Disk Scheduling: I/O Devices, Organization of the I/O Function, I/O Buffering, Disk Scheduling (FIFO, SSTF, SCAN, C-SCAN, LOOK, C-LOOK).
File Management: Overview-Files and File Systems, File structure. File Organization and Access, File Directories, File Sharing, Record Blocking, Secondary Storage Management.
Case Study: Linux File Management versus Windows File Management

Mapping of Course Outcomes for Unit V	**CO5**

Unit VI	**INTRODUCTION TO SYSTEMS SOFTWARE**	**(4 hrs)**

Need of System Software, study of various components of system software.
Assemblers: Elements of Assembly Language Programming, A simple Assembly Scheme and pass structure of Assemblers.
Introduction to compilers: Phase structure of Compiler and entire compilation process.
Introduction to Macro processors, Loaders and Linkers.

Mapping of Course Outcomes for Unit VI	**CO6**

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,2012, ISBN 978-1-118-06333-0
3. D. M. Dhamdhere, Systems Programming and Operating Systems, Tata McGraw-Hill, ISBN 13:978-0-07-463579-7, Second Revised Edition.

1. Tom Adelstein and Bill Lubanovic, Linux System Administration, O'Reilly Media, ISBN-10: 0596009526, ISBN-13: 978-0596009526.
2. Harvey M. Deitel, Operating Systems, Prentice Hall, ISBN-10: 0131828274, ISBN-13: 978-0131828278.
3. Thomas W. Doeppner, Operating System in depth: Design and Programming, WILEY, ISBN: 978-0-471-68723-8.
4. Mendel Cooper, Advanced Shell Scripting, Linux Documentation Project.
5. Andrew S. Tanenbaum & Herbert Bos, Modern Operating System, Pearson, ISBN-13: 9780133592221, 4th Edition.
6. J. J. Donovan, Systems Programming, McGraw-Hill, ISBN 13:978-0-07-460482-3, Indian Edition.

Home

Savitribai Phule Pune University, Pune
Second Year Artificial Intelligence & Machine Learning (2020 Course)
218553: Fundamentals of Artificial Intelligence and Machine Learning

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory(TH):03hrs/week	03	Mid_Semester: 30 Marks End_Semester: 70 Marks

Prerequisite Courses, if any: Discrete Mathematics, Any Programming Knowledge (Python/ Matlab /Java).

Course Objectives: The objectives of this course is

1. To understand the basic concept of AI & ML.
2. To understand strength and weakness of problem solving and search algorithms.
3. To know about basic concepts of knowledge, and reasoning, Machine Learning.
4. To optimize the different linear methods of regression and classification.
5. To interpret the different supervised classification methods of support vector machine and tree based models.

Course Outcomes:

On completion of this course student will be able to --

CO1: Evaluate Artificial Intelligence (AI) methods and describe their foundations.
CO2: Analyze and illustrate how search algorithms play vital role in problem solving, inference, perception, knowledge representation and learning.
CO3: Demonstrate knowledge of reasoning and knowledge representation for solving real world problems
CO4: Recognize the characteristics of machine learning that makes it useful to real-world problems
CO5: Apply the different supervised learning methods of support vector machine and tree based models.
CO6: Use different linear methods for regression and classification with their optimization through different regularization techniques.

COURSE CONTENTS

Unit I	Introduction to AI	06 hrs

Basic Definitions and terminology, Foundation and History of AI, Overview of AI problems, Evolution of AI,- Applications of AI, Classification/Types of AI. Artificial Intelligence vs Machine learning.

Intelligent Agent: Types of AI Agent, Concept of Rationality, nature of environment, structure of agents. Turing Test in AI.

Mapping of Course Outcomes for Unit I	CO1

Unit II	Problem Solving	06 hrs

Search Algorithms in Artificial Intelligence: Terminologies, Properties of search Algorithms, Types of search algorithms: uninformed search and informed search, State Space search **Heuristic Search Techniques: Generate-and-Test; Hill Climbing; Properties of A* algorithm, Best-first Search; Problem Reduction.** **Constraint Satisfaction problem:** Interference in CSPs; Back tracking search for CSPs; Local Search for CSPs; structure of CSP Problem. **Beyond Classical Search:** Local search algorithms and optimization problem, local search in continuous spaces, searching with nondeterministic action and partial observation, online search agent and unknown environments.		
Mapping of Course Outcomes for Unit II	**CO2**	
Unit III	**Knowledge and Reasoning**	**06 hrs**
Knowledge-Based Agent in Artificial intelligence: Architecture, Approaches to designing a knowledge-based agent, knowledge representation: Techniques of knowledge representation, Propositional logic, Rules of Inference, First-Order Logic, Forward Chaining and backward chaining in AI, **Reasoning in Artificial intelligence:** Types of Reasoning and Probabilistic reasoning, Uncertainty.		
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**Introduction to ML**	**06 hrs**
Introduction to Machine Learning: History of ML Examples of Machine Learning Applications, Learning Types, ML Life cycle, AI & ML, dataset for ML, Data Pre-processing, Training versus Testing, Positive and Negative Class, Cross-validation.		
Mapping of Course Outcomes for Unit IV	**CO4**	
Unit V	**Learning**	**06 hrs**
Types of Learning: Supervised, Unsupervised and Semi-Supervised Learning. **Supervised:** Learning a Class from Examples, Types of supervised Machine learning Algorithms, **Unsupervised:** Types of Unsupervised Learning Algorithm, Dimensionality Reduction: Introduction to Dimensionality Reduction, Subset Selection, and Introduction to Principal Component Analysis.		
Mapping of Course Outcomes for Unit V	**CO5**	
Unit VI	**Classification & Regression**	**06 hrs**
Classification: Binary and Multiclass Classification: , Assessing Classification Performance, Handling more than two classes, Multiclass Classification-One vs One, One vs Rest. **Regression:** Assessing performance of Regression – Error measures, Overfitting and Underfitting,		

Catalysts for Overfitting, VC Dimensions.	
Mapping of Course Outcomes for Unit VI	**CO6**

Text Books:

1. Russell, S. and Norvig, P. 2015. Artificial Intelligence - A Modern Approach, 3rd edition, Prentice Hall
2. J. Gabriel, Artificial Intelligence: Artificial Intelligence for Humans (Artificial Intelligence, Machine Learning), Create Space Independent Publishing Platform, First edition , 2016
3. Peter Flach: Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press, Edition 2012.

Reference Books:

1. Introduction to Artificial Intelligence & Expert Systems, Dan W Patterson, PHI., 2010 2. S Kaushik, Artificial Intelligence, Cengage Learning, 1st ed.2011.
2. Ric, E., Knight, K and Shankar, B. 2009. Artificial Intelligence, 3rd edition, Tata McGraw Hill.
3. Luger, G.F. 2008. Artificial Intelligence -Structures and Strategies for Complex Problem Solving, 6th edition, Pearson.
4. Alpaydin, E. 2010. Introduction to Machine Learning. 2nd edition, MIT.
5. Ethem Alpaydin: Introduction to Machine Learning, PHI 2nd Edition-2013.
6. Nilsson Nils J, “Artificial Intelligence: A new Synthesis, Morgan Kaufmann Publishers Inc. San Francisco, CA, ISBN: 978-1-55-860467-4.

Home

Savitribai Phule Pune University, Pune
Second Year Artificial Intelligence & Machine Learning (2020 Course)
218554 : Database Management System

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory(TH):03hrs/week	03	Mid_Semester: 30 Marks End_Semester: 70 Marks

Prerequisite Courses, if any: Discrete Mathematics

Course Objectives:

1. The objective of the course is to present an introduction to database management system as a subject in its own right.
2. To understand the fundamental concepts of Relational Database management system.
3. To present SQL and procedural interfaces to SQL comprehensively.
4. To provide a strong formal foundation in Relational Database Concepts, database concepts, technology and practice &to introduce the concepts of Query Processing.
5. To introduce the concepts of Transaction Processing and to present the issues and techniques relating to concurrency and recovery in multi-user database environments.
6. To introduce the recent trends in database technology.

Course Outcomes:

On completion of this course student will be able to --

CO1: Apply fundamental elements of database management systems.
CO2: Design ER-models to represent simple database application scenarios.
CO3: Formulate SQL queries on data for relational databases.
CO4: Improve the database design by normalization & to incorporate query processing.
CO5: Apply ACID properties for transaction management and concurrency control.
CO6: Analyze various database architectures and technologies.

COURSE CONTENTS

Unit I	Introduction to DBMS	06 hrs

Introduction : Basic concepts, Advantages of DBMS over file processing systems, Data abstraction, Database languages, Data models, Data independence, Components of a DBMS, Overall structure of DBMS, Multi-user DBMS architecture, System catalogs, Data Modeling: Basic concepts, Entity, attributes, relationships, constraints, keys.

Case Study	**MySQL Database**
Mapping of Course Outcomes for Unit I	**CO1**

Unit II	Relational Model	06 hrs

ER and EER diagrams: Components of ER model, Conventions, Converting ER diagrams into tables Relational Model: Basic concepts, Attributes and Domains, Codd's rules.

Relational Integrity: Nulls, Entity, Referential integrities, Enterprise constraints, Views, Schema diagram		
Case Study	**Student / Timetable / Reservation / any data Management System**	
Mapping of Course Outcomes for Unit II	**CO2**	
Unit III	**Introduction to SQL - PL/SQL**	**06 hrs**
Introduction to SQL: Characteristics and advantages SQL Data Types, Literals, DDL, DML, SQL Operators Tables: Creating, Modifying, Deleting, Views: Creating, Dropping, Updation using Views, Indexes, Nulls. **SQL DML Queries**: SELECT query and clauses, Set operations, Tuple Variables, Set comparison, Ordering of Tuples , Aggregate Functions, Nested Queries, Database Modification using SQL Insert, Update, Delete Queries, Stored Procedure, Triggers, Programmatic **SQL** : Embedded SQL, Dynamic SQL, ODBC		
Case Study	**Employee database system**	
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**Database Design & Query Processing**	**06 hrs**
Relational Databases Design: Purpose of Normalization, Data Redundancy and Update Anomalies, Functional Dependencies. The process of Normalization: 1NF, 2NF, 3NF, BCNF. Introduction to **Query Processing:** Overview, Measures of Query cost, Selection and Join operations, Evaluation of Expressions **Introduction to Query optimization:** Estimation, Transformation of Relational Expression		
Case Study	**Employee Database design**	
Mapping of Course Outcomes for Unit IV	**CO4**	
Unit V	**Transaction & Concurrency Control**	**06 hrs**
Transaction Management: Basic concept of a Transaction, Properties of Transactions, Database Architecture, Concept of Schedule, Serial Schedule. **Serializability:** Conflict and View, Cascaded aborts Recoverable and Non-recoverable Schedules. **Concurrency Control:** Need Locking methods Dead locks, Time stamping Methods. Optimistic Techniques, Multi-version Concurrency Control. **Different crash recovery methods:** Shadow-Paging, Log-based Recovery: Deferred and Immediate, Check Points		
Case Study	**Banking Transaction**	

Mapping of Course Outcomes for Unit V	**CO5**	
Unit VI	**Advanced Databases**	**06 hrs**
Database Architectures: Centralized and Client-Server Architectures, 2 Tier and 3 Tier Architecture, Introduction to Parallel Databases, Key elements of Parallel Database Processing, Architecture of Parallel Databases, Introduction to Distributed Databases, Architecture of Distributed Databases, Distributed Database Design. **Emerging Database Technologies:** Introduction, No SQL Databases- Internet Databases, Cloud databases, Mobile Databases, SQLite database, XML databases		
Case Study	**RealmDB, ORMLite, Couchbase Lite**	
Mapping of Course Outcomes for Unit VI	**CO6**	

Text Books:

1. Silberschatz A., Korth H., Sudarshan S. "Database System Concepts", 6th edition, Tata McGraw Hill Publishers
2. G. K. Gupta "Database Management Systems" , Tata McGraw Hill

Reference Books:

1. Rab P., Coronel C. "Database Systems Design, Implementation and Management", 5th edition, Thomson Course Technology, 2002
2. Elmasri R., Navathe S. " Fundamentals of Database Systems", 4th edition, Pearson Education, 2003
3. Date C. " An Introduction to Database Systems", 7th edition, Pearson Education, 2002
4. Ramkrishna R., Gehrke J. " Database Management Systems", 3rd edition, McGraw Hill

Web Resources:

https://nptel.ac.in/courses/106/105/106105175/

Home

Savitribai Phule Pune University, Pune
Second Year Artificial Intelligence & Machine Learning (2020 Course)
218555 : Computer Graphics

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory (TH): 03 hrs/week	03	Mid_Semester: 30 Marks End_Semester: 70 Marks

Prerequisite Courses, if any: Basic Geometry, Trigonometry, Vectors and Matrices, Data Structures and Algorithms.

Course Objectives:

1. Understand the foundations of computer graphics: hardware systems, math basis, light and color.
2. Understand the complexities of modeling realistic objects through modeling complex scenes using a high-level scene description language.
3. Become acquainted with some advanced topics in computer graphics. The student should gain an expanded vocabulary for discussing issues relevant to computer graphics (including both the underlying mathematics and the actual programming).
4. The student should gain an appreciation and understanding of the hardware and software utilized in constructing computer graphics applications.
5. The student should gain a comprehension of windows, clipping and view-ports in relation to images displayed on screen.
6. The student should gain an understanding of geometric, mathematical and algorithmic concepts necessary for programming computer graphics.

Course Outcomes:

On completion of the course, students will be able to–

CO1: Apply mathematical and logical aspects for developing elementary graphics operations like scan conversion of points, lines, circle, and apply it for problem solving.

CO2: Employ techniques of geometrical transforms to produce, position and manipulate Objects in 2 dimensional and 3-dimensional space respectively.

CO3: Describe mapping from a world coordinates to device coordinates, clipping, and projections in order to produce 3D images on 2D output device.

CO4: Apply concepts of rendering, shading, animation, curves and fractals using computer graphics tools in design, development and testing of 2D, 3D modeling applications.

CO5: Perceive the concepts of virtual reality.

COURSE CONTENTS

Unit – I	Computer Graphics Basic, OpenGL and Line, Circle Drawing	06 hrs

Introduction CG :Introduction to computer graphics, basics of graphics systems, raster and random scan, basic display processor

OpenGL – Introduction – Graphics function, OpenGL Interface, primitives and attributes, Control functions, programming events.

Line Drawing: DDA Line drawing algorithm, Bresenham Line drawing algorithm

Circle Drawing: Bresenham circle drawing algorithm. **Character Generation:** Stroke principle, starburst principle, bitmap method. Introduction to aliasing and anti-aliasing.		
Case Study	**Computer-generated imagery (CGI)**	
Mapping of Course Outcomes for Unit I	**CO1**	
Unit – II	**Polygons, 2D Transformations**	**06 hrs**
Polygons: Polygons and its types, inside test, Polygon filling methods: Seed Fill – Flood fill and Boundary Fill, Scan-line Fill algorithms, **2D Transformations:** Translation, Scaling, Rotation, Reflection and Shearing, Matrix representation and homogeneous coordinate system, composite transformations.		
Case Study	**Transformation of an Object in Computer Graphics: Mathematical Matrix Theory**	
Mapping of Course Outcomes for Unit II	**CO2**	
Unit – III	**Windowing, Clipping,3D Transformation, Projections**	**06 hrs**
Windowing: Concept of window and viewport, viewing transformations **Line Clipping:** Cohen Sutherland method of line clipping **Polygon Clipping:** Sutherland Hodgeman method for convex and concave polygon clipping. **3D Transformation:** Translation, scaling, rotation about X, Y, Z & arbitrary axis, and reflection about XY, YZ, XZ & arbitrary plane. **Projections:** Types of projections- Parallel, Perspective **Parallel:** oblique – Cavalier, Cabinet, Orthographic – isometric, diametric, trimetric **Perspective:** vanishing points as 1 point, 2 point and 3 point.		
Case Study	**3D Rendering and Modeling**	
Mapping of Course Outcomes for Unit III	**CO2 & CO3**	
Unit – IV	**Segments, Illumination models, colour models and shading**	**06 hrs**
Segments: Introduction, Segment table, segment creation, closing, deleting, renaming, and visibility. **Illumination models**: Light sources, ambient light, diffuse light, specular reflection, the Phong model, combined diffuse and specular reflections with multiple light sources. **Color Models:** CIE Chromaticity Diagram, Color Gamut, RGB, CMY, YCbCr,HSVcolor models. **Shading Algorithms:** Constant intensity shading, Halftone, Gourand and Phong Shading.		
Case Study	**Best practices in Day lighting& Passive Systems for Smaller Commercial Buildings**	
Mapping of Course Outcomes for Unit IV	**CO4**	

Unit – V	**Curves, fractals and Animation**	**06 hrs**
Curves: Introduction, interpolation and approximation, Spline Interpolation Methods – hermite interpolation, Bezier curves, B-Splines. **Fractals:** Introduction, Classification, fractal Dimension, Fractal dimension and surfaces, Hilbert curve, Koch Curve. **Animation:** Basics of animation, types of animation, principles of animation, design of animation sequences, animation languages, key frame, morphing, motion specification. Methods of controlling animation, frame-by-frame animation techniques, real-time animation techniques.		
Case Study	**3D Animation services for character expressions.**	
Mapping of Course Outcomes for Unit V	**CO4**	
Unit – VI	**Virtual Reality**	**06 hrs**
Introduction of Virtual Reality: Fundamental Concept, Three I's of virtual reality and Classic Components of VR systems, Applications of VR systems. **Multiple Modals of Input and Output Interface in Virtual Reality:** Input – 3D position Trackers and its types, Navigation and Manipulation Interfaces, Gesture Interfaces, Graphics Displays – HMD and CAVE, Sound Displays, Haptic Feedback **Rendering Pipeline:** Graphics rendering Pipeline, Haptics Rendering Pipeline Modeling in Virtual Reality: Concepts of Geometric Modeling, Kinematic Modeling, Physical modeling and Behavior modeling.		
Case Study	**Virtual reality in aviation and Space travel Training**	
Mapping of Course Outcomes for Unit VI	**CO5**	

Test Books

1. D. Hearn, M. Baker, "Computer Graphics – C Version", 2nd Edition, Pearson Education, 2002, ISBN81 – 7808 – 794 – 4
2. S. Harrington, "Computer Graphics", 2nd Edition, McGraw-Hill Publications, 1987, ISBN 0 – 07 – 100472 – 6
3. Grigore C. Burdea, Philippe Coiffet, "Virtual Reality Technology", second edition, Wiley India Edition, ISBN 81-265-0789-6

Reference books

1. D. Rogers, "Procedural Elements for Computer Graphics", 2nd Edition, Tata McGraw-Hill Publication, 2001, ISBN 0 – 07 – 047371 – 4.
2. J. Foley, V. Dam, S. Feiner, J. Hughes, "Computer Graphics Principles and Practice", 2nd Edition, Pearson Education, 2003, ISBN 81 – 7808 – 038 – 9.
3. Foley, "Computer Graphics: Principles & Practice in C", 2e, ISBN 9788131705056, Pearson Edu.
4. F.S. Hill JR, "Computer Graphics Using Open GL", Pearson Education.

Savitribai Phule Pune University, Pune
Second Year Artificial Intelligence & Machine Learning (2020 Course)
218556 : Operating System Laboratory

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical (PR) : 2 hrs/week	1	PR : 25 Marks TW : 25 Marks

Prerequisites: 1. C Programming
2. Data Structure

Course Objectives :

1. To introduce and learn Linux commands required for administration.
2. To learn shell programming concepts and applications.
3. To demonstrate the functioning of OS basic building blocks like processes, threads under the LINUX.
4. To demonstrate the functioning of OS concepts in user space like concurrency control (process synchronization, mutual exclusion), CPU Scheduling, Memory Management and Disk Scheduling in LINUX.
5. To demonstrate the functioning of Inter Process Communication under LINUX.

Course Outcomes :

On completion of the course, students will be able to–

1. To apply the basics of Linux commands.
2. To build shell scripts for various applications.
3. To implement basic building blocks like processes, threads under the Linux.
4. To develop various system programs for the functioning of OS concepts in user space like concurrency control, CPU Scheduling, Memory Management and Disk Scheduling in Linux.
5. To develop system programs for Inter Process Communication in Linux.

Guidelines for Instructor's Manual

The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/Assistant.

Guidelines for Student's Lab Journal

1. Student should submit term work in the form of handwritten journal based on specified list of assignments.
2. Practical Examination will be based on the term work.
3. Candidate is expected to know the theory involved in the experiment.
4. The practical examination should be conducted if and only if the journal of the candidate is complete in all aspects.

Guidelines for Lab /TW Assessment

1. Examiners will assess the term work based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of handwritten write-up along with results of implemented assignment, attendance etc.

2. Examiners will judge the understanding of the practical performed in the examination by asking some questions related to the theory & implementation of the experiments he/she has carried out.

3. Appropriate knowledge of usage of software and hardware related to respective laboratory should be checked by the concerned faculty member

Guidelines for Laboratory Conduction

As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers of the program in journal may be avoided. There must be hand-written write-ups for every assignment in the journal. The DVD/CD containing students programs should be attached to the journal by every student and same to be maintained by department/lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory.

Guidelines for Practical Examination

1. There will be 2 problem statements options and student will have to perform any one.
2. All the problem statements carry equal weightage.

List of Laboratory Assignments

Assignment No. 1 a. Study of Basic Linux Commands: echo, ls, read, cat, touch, test, loops, arithmetic comparison, conditional loops, grep, sed etc. - **CO1**

b. Write a program to implement an address book with options given below: a) Create address book. b) View address book. c) Insert a record. d) Delete a record. e) Modify a record. f) Exit - **CO2**

Assignment No. 2: Process control system calls: The demonstration of FORK, EXECVE and WAIT system calls along with zombie and orphan states. – **CO3**

a. Implement the C program in which main program accepts the integers to be sorted. Main program uses the FORK system call to create a new process called a child process. Parent process sorts the integers using sorting algorithm and waits for child process using WAIT system call to sort the integers using any sorting algorithm. Also demonstrate zombie and orphan states.

b. Implement the C program in which main program accepts an array. Main program uses the FORK system call to create a new process called a child process. Parent process sorts an array and passes the sorted array to child process through the command line arguments of EXECVE system call. The child process uses EXECVE system call to load new program which display array in reverse order.

Assignment No. 3: Implement the C program for CPU Scheduling Algorithms: Shortest Job First (Preemptive) and Round Robin with different arrival time. – **CO4**

Assignment No. 4: - **CO4**

a. Thread synchronization using counting semaphores. Application to demonstrate: producer-consumer problem with counting semaphores and mutex.
b. Thread synchronization and mutual exclusion using mutex. Application to demonstrate: Reader-Writer problem with reader priority.

Assignment No. 5: Implement the C program for Deadlock Avoidance Algorithm: Bankers Algorithm. – **CO4**

Assignment No. 6: Implement the C program for Page Replacement Algorithms: FCFS, LRU, and Optimal for frame size as minimum three. – **CO4**

Assignment No. 7: Inter process communication in Linux using following. – **CO5**

a. FIFOs: Full duplex communication between two independent processes. First process accepts sentences and writes on one pipe to be read by second process and second process counts number of characters, number of words and number of lines in accepted sentences, writes this output in a text file and writes the contents of the file on second pipe to be read by first process and displays on standard output.

b. Inter-process Communication using Shared Memory using System V. Application to demonstrate: Client and Server Programs in which server process creates a shared memory segment and writes the message to the shared memory segment. Client process reads the message from the shared memory segment and displays it to the screen.

Assignment No. 8: Implement the C program for Disk Scheduling Algorithms: SSTF, SCAN, C-Look considering the initial head position moving away from the spindle. - **CO4**

Reference Books:

1. Das, Sumitabha, UNIX Concepts and Applications, TMH, ISBN-10: 0070635463, ISBN-13: 978-0070635463, 4th Edition.
2. Kay Robbins and Steve Robbins, UNIX Systems Programming, Prentice Hall, ISBN-13: 978-0134424071, ISBN-10: 0134424077, 2nd Edition.
3. Mendel Cooper, Advanced Shell Scripting Guide, Linux Documentation Project, Public domain.
4. Yashwant kanetkar, UNIX Shell Programming, BPB Publication.

Home

Savitribai Phule Pune University, Pune
Second Year Artificial Intelligence & Machine Learning (2020 Course)
218557 : Computer Graphics Laboratory

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical (PR) :02hrs/week	01	PR : 25 Marks

Prerequisites: Basic Geometry, Trigonometry, Vectors and Matrices, Data Structures and Algorithms

Course Objectives :

1. To acquaint the learners with the concepts of OpenGL.
2. To acquaint the learners with the basic concepts of Computer Graphics.
3. To implement the various algorithms for generating and rendering the objects.
4. To get familiar with mathematics behind the transformations.
5. To understand and apply various methods and techniques regarding animation.

Course Outcomes :

On completion of this course student will be able to --

CO1: Apply line& circle drawing algorithms to draw the objects.
CO2: Apply polygon filling methods for the object.
CO3: Apply polygon clipping algorithms for the object.
CO4: Apply the 2D transformations on the object.
CO5: Implement the curve generation algorithms.
CO6: Demonstrate the animation of any object using animation principles.

Guidelines for Instructor's Manual

The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/Assistant.

Guidelines for Student's Lab Journal

1. Student should submit term work in the form of journal with write-ups based on specified list of assignments.
2. Practical and Oral Examination will be based on all the assignments in the lab manual
3. Candidate is expected to know the theory involved in the experiment.
4. The practical examination should be conducted if and only if the journal of the candidate is complete in all respects.

Guidelines for Lab /TW Assessment

1. Examiners will assess the student based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of write-ups along with results of implemented assignment, attendance etc.

2. Examiners will judge the understanding of the practical performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried out. **3.** Appropriate knowledge of usage of software related to respective laboratory should be checked by the concerned faculty member.
Guidelines for Laboratory Conduction
1. All the assignments should be implemented in C++ with OpenGL libraries. **2.** Assignment 1 (week 1) should cover all the basic functions of openGL to get students familiar with Graphics Environment. Hence, this assignment is not included in Practical Exam. **3.** The different objects/shapes/patterns should be drawn for implementation of drawing algorithm. **4.** All the assignments should explore the conceptual understanding of students. **5.** The keyboard/Mouse interfaces should be used wherever possible.
Guidelines for PRACTICAL EXAM conduction
3. There will be 2 problem statements options and student will have to perform any one. **4.** All the problem statements carry equal weightage.
Virtual Laboratory
• **https://cse18-iiith.vlabs.ac.in/** • **http://vlabs.iitb.ac.in/vlabs-dev/labs/cglab/index.php**
Suggested List of Laboratory Assignments
1. Install and explore the OpenGL -- **CO1**
2. Implement DDA and Bresenham line drawing algorithm to draw: i) Simple Line ii) Dotted Line iii) Dashed Line iv) Solid line; using mouse interface Divide the screen in four quadrants with center as (0, 0). The line should work for all the slopes positive as well as negative.
3. Implement Bresenham circle drawing algorithm to draw any object. The object should be displayed in all the quadrants with respect to center and radius- **C02**
4. Implement the following polygon filling methods : i) Flood fill / Seed fill ii) Boundary fill ; using mouse click, keyboard interface and menu driven programming**- CO4**
5. Implement Cohen Sutherland polygon clipping method to clip the polygon with respect the viewport and window. Use mouse click, keyboard interface - **CO4**
6.Implement following 2D transformations on the object with respect to axis : – **CO5** i) Scaling ii) Rotation about arbitrary point iii) Reflection
7. Generate fractal patterns using i) Bezier ii) Koch Curve - **CO5**
8. Implement animation principles for any object - **CO6**
Text Books
1. S. Harrington, "Computer Graphics", 2nd Edition, McGraw-Hill Publications, 1987, ISBN 0-07-

100472-6

2. D. Rogers, "Procedural Elements for Computer Graphics", 2nd Edition, McGraw-Hill Publications, 1987, ISBN 0-07-047371-4

3. F.S. Hill JR, "Computer Graphics Using OpenGL", Pearson Education

Reference Books

1. Graphics Principles and Practice", 2nd Edition, Pearson Education, 2003, ISBN 81 – 7808 – 038 – 9

2. D.Hearn, M. Baker, "Computer Graphics – C Version", 2nd Edition, Pearson Education, 2002, ISBN81 – 7808 – 794 – 4

3. D. Rogers, J. Adams, "Mathematical Elements for Computer Graphics", 2nd Edition, Tata McGraw-Hill Publication, 2002, ISBN 0 – 07 – 048677 – 8

4. Zhigang Xiang, Roy Plastock, "Computer Graphics", Schaum's Series outlines

5. Shirley, Marschner, "Fundamentals of Computer Graphics", Third Ed, A K Peters SPD

6. D.P. Mukharjee, Debasish Jana, "Computer Graphics Algorithms and implementation", PHI Learning

7. Samuel R. Buss, "3D Computer Graphics", Cambridge University Press

8. Mario Zechner, Robert Green, "Beginning Android 4 Games Development", Apress, ISBN: 978-81-322-0575-3

9. Maurya, "Computer Graphics with Virtual Reality Systems, 2ed.", Wiley, ISBN-9788126550883

10. Foley, "Computer Graphics: Principles & Practice in C", 2e, ISBN 9788131705056, Pearson

Home

Savitribai Phule Pune University, Pune
Second Year Artificial Intelligence & Machine Learning (2020 Course)
: Database Management System Laboratory

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical (PR): 04hrs/week	02	PR: 25 Marks TW: 25 Marks

Prerequisites: Data structures and Software engineering principles and practices.

Course Objectives :

1. Understand the fundamental concepts of database management. These concepts include aspects of database design, database languages, and database-system implementation.
2. To provide a strong formal foundation in database concepts, recent technologies and best industry practices.
3. To give systematic database design approaches covering conceptual design, logical design and an overview of physical design.
4. To learn the SQL database system.
5. To learn and understand various Database Architectures and its use for application development.
6. To program PL/SQL including stored procedures, stored functions, cursors and packages.

Course Outcomes :

On completion of this course student will be able to --

CO1: Install and configure database systems.
CO2: Analyze database models & entity relationship models.
CO3 : Design and implement a database schema for a given problem-domain
CO4: Implement relational database systems.
CO5: Populate and query a database using SQL DDL / DML / DCL commands.
CO6 : Design a backend database of any one organization: CASE STUDY

Guidelines for Instructor's Manual

The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/Assistant.

Guidelines for Student's Lab Journal

1. Student should submit term work in the form of journal with write-ups based on specified list of assignments.
2. Practical and Oral Examination will be based on all the assignments in the lab manual
3. Candidate is expected to know the theory involved in the experiment.
4. The practical examination should be conducted only if the journal of the candidate is complete in all respects.

Guidelines for Oral /Practical Assessment

1. Examiners will assess the student based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for

implementation of practical assignment, timely submission of assignment in the form of handwritten write-up along with results of implemented assignment, attendance etc.

2. Examiners will judge the understanding of the practical performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried out.
3. Appropriate knowledge of usage of software and hardware related to respective laboratory should be checked by the concerned faculty member.

Suggested List of Laboratory Assignments

Group A: Study of Databases

Mapping of Course Outcomes Group A -- CO1

1. Study of MySQL Open source software. Discuss the characteristics like efficiency, scalability, performance and transactional properties
2. Install and configure client and server of MySQL.(Show all commands and necessary steps for installation and configuration)
3. Study of SQLite: What is SQLite? Uses of Sqlite. Building and installing SQLite.

Group B: MySQL

Mapping of Course Outcomes Group B -- CO2, CO3, CO4, CO5

1. Design any database with at least 3 entities and relationships between them. Draw suitable ER/EER diagram for the system.
2. Design and implement a database (for assignment no 1) using DDL statements and apply normalization on them
3. Create Table with primary key and foreign key constraints.
   a. Alter table with add n modify b. Drop table
4. Perform following SQL queries on the database created in assignment 1.
   - Implementation of relational operators in SQL
   - Boolean operators and pattern matching
   - Arithmetic operations and built in functions
   - Group functions
   - Processing Date and Time functions
   - Complex queries and set operators
5. Execute DDL/DML statements which demonstrate the use of views. Update the base table using its corresponding view. Also consider restrictions on updatable views and perform view creation from multiple tables.

Group C: PL/SQL

Mapping of Course Outcomes Group C -- CO6

1. Write and execute PL/SQL stored procedure and function to perform a suitable task on the database. Demonstrate its use.
2. Write and execute suitable database triggers .Consider row level and statement level triggers.
3. Write a PL/SQL block to implement all types of cursor.

Group D: Relational Database Design
Mapping of Course Outcomes Group D -- CO5, CO6
Design and case study of any organization (back end only), Project Proposal and High Level SRS To prepare for project, do the following: 1. Form teams of around 3 to 4 people 2. Create requirements document with the following information:- a. Give one or two paragraph description of your goals for the topic(s). b. List what all types of users will be accessing your application c. List the various functionalities that your application will support. Explain each in about a paragraph worth of detail. d. List the hardware and software requirements at the backend and at the front end. e. Give an estimate of the number of users of each type, the expected load (transactions per day), and the expected database size.
Project ER Diagram and Database Design
For ER diagram and Database design following guidelines can be used: 1. Draw an ER diagram of your project. 2. Reduce this ER diagram into the tables and complete database design. 3. Subsequently, list all the functional dependencies on each table that you expect will hold. 4. Check that the database schema is in 3NF/BCNF. If it is not, apply normalization. Use non-loss decomposition and bring the database schema in 3NF/BCNF. Give the ER diagram and the data dictionary as part of the requirement specifications file which you created for the project proposal.
Reference Books:
1. Dr. P. S. Deshpande, “SQL and PL/SQL for Oracle 10g Black Book”, DreamTech 2. Ivan Bayross, “SQL, PL/SQL: The Programming Language of Oracle”, BPB Publication 3. Reese G., Yarger R., King T., Williums H, “Managing and Using MySQL”, Shroff Publishers and Distributors Pvt. Ltd., ISBN: 81 - 7366 - 465 – X, 2nd Edition 4. Eric Redmond, Jim Wilson, “Seven databases in seven weeks”, SPD, ISBN: 978-93-5023-91 5. Jay Kreibich, Using SQLite, SPD, ISBN: 978-93-5110-934-1, 1st edition

Home

Savitribai Phule Pune University, Pune
Second Year Artificial Intelligence & Machine Learning (2020 Course)
218559 : Project Based Learning - II

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical (PR): 04hrs/week	02	TW : 50 Marks

Prerequisite Courses, if any:

Preamble:

Project Based Learning (PBL) is an instructional approach that emphasizes critical-thinking, collaboration and personalized learning. In PBL, student groups engage in meaningful inquiry that is of personal interest to them. These projects are based on problems, which are real-life oriented, curriculum-based and often interdisciplinary. Students decide how to approach a problem and what activities or processes they will perform. They collect information from a variety of sources, analyze, synthesize and derive understanding from it. The real-world focus of PBL activities is central to the process because it motivates students and adds value to their work. Their learning is connected to something real and involves life skills such as collaboration and reflection. The faculty assigned to the group is referred as mentor. Technology enables students and Mentor in various phases of the PBL process. At the end of the PBL, students demonstrate their newly acquired knowledge and are evaluated by how much they have learned and how well they communicate it. Students also conduct self-evaluation to assess their own growth and learning. Throughout this process, the mentor's role is to guide and advise students, rather than to direct and manage student work.

Companion Course: Online courses relevant to the project, along with expert lecture on Intellectual property rights, patents and software engineering.

Course Objectives :

1. To learn the various processes involved in project based learning.
2. To develop critical thinking and engineering problem solving skills amongst the students.
3. To explain the roles and responsibilities of IT engineers to the solution of engineering problems within the social, environmental and economic context.
4. To equip the students with knowledge and skills require to develop solutions for the problems coming from various Hackathon.

Course Outcomes

On completion of the course, student will be able to --

CO1: Design solution to real life problems and analyze its concerns through shared cognition.

CO2: Apply learning by doing approach in PBL to promote lifelong learning.

CO3: Tackle technical challenges for solving real world problems with team efforts.

CO4: Collaborate and engage in multi-disciplinary learning environments.

COURSE CONTENTS

Group Structure

Group structure should enable students to work in mentor–monitored groups. The students plan, manage and complete a task/project / activity which addresses the stated problem.

1. There should be a team of 3 to 6 students who will work cohesively.
2. A Mentor should be assigned to individual groups who will help them with learning and development process.

Selection of Project/Problem

1. The project scope/topic can be from any field/area, but selection related to IT technical aspect is desirous.
2. The project/problem done in first year engineering could be extended further, based on its potential and significance analysis.
3. Project/problem requiring solutions through conceptual model development and use of software tools should be preferred.
4. Different alternate approaches such as theoretical, practical, working model, demonstration or software analysis should be used in solving/implementing of project/problem.
5. The project/problem requiring multi-disciplinary approach to solve it, should be preferred.
6. Problem may require in depth study of specific practical, scientific or technical domain.
7. Hands-on activities, organizational and field visits, interacting with research institutes and expert consultation should be included in the approach to make students aware of latest technologies.

Assessment

The department should be committed to assess and evaluate both student performance and solution impact.

Progress of PBL will be monitored regularly on weekly basis. Weekly review of the work is necessary. During process of monitoring and continuous assessment and evaluation the individual and team performance is to be measured by mentor.

Students must maintain an institutional culture of authentic collaboration, self- motivation, peer-learning and personal responsiveness. The institution/department should support students in this regard through guidance/orientation programs and the provision of appropriate resources and services. Supervisor/mentor and students must actively participate in assessment and evaluation processes. Group may demonstrate their knowledge and skills by developing a public product and/or report and/or presentation.

1. Individual assessment for each student (Understanding individual capacity, role and involvement in the project).

2. Group assessment (roles defined, distribution of work, intra-team communication and togetherness.

3. Documentation and presentation.

Evaluation and Continuous Assessment
It is recommended that the all activities are to be recorded in PBL workbook, regular assessment of work to be done and proper documents are to be maintained at college end by both students as well as mentor. The PBL workbook will reflect accountability, punctuality, technical writing ability and work flow of the task undertaken. Continuous Assessment Sheet (CAS) is to be maintained by all mentors/department. Recommended parameters for assessment, evaluation and weightage: 1. Idea Inception (5%) 2. Outcomes of PBL/Problem Solving Skills/Solution provided/Final product**(40%)** (Individual assessment and team assessment) 3. Documentation (Gathering requirements, design & modeling, implementation/execution, use of technology and final report, other documents **(25 %)** 4. Potential for the patent **(10%)** 5. Demonstration (Presentation, User Interface, Usability etc.) **(10%)** 6. Contest Participation/ publication **(5%)** 7. Awareness /Consideration of Environment/ Social /Ethics/ Safety measures/Legal aspects **(5%).** Design the rubrics based on the above parameters for evaluation of student performance
Faculty / Mentor is expected to perform following activities
Faculty/ Mentor is expected to perform following activities: Revision of PBL concepts Skill assessment of students Formation of diversified and balanced groups Share information about patent, copyright and publications to make students aware about it Discussion of sample case studies Design of the rubrics for evaluation of student performance Discussion of the rubrics with students Weekly Assessment of the deliverables such as Presentation, Report, Concept map, logbook Scaffolding of the students Summative and Formative assessment
Reference Books:
1. Project-Based Learning, Edutopia, March 14,2016. 2. What is PBL? Buck Institute forEducation. 3. www.schoology.com 4. www.wikipedia.org 5. www.howstuffworks.com

Home

Savitribai Phule Pune University, Pune
Second Year Artificial Intelligence & Machine Learning (2020 Course)
218560 : Code of Conduct

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Tutorial : 01 hrs/week	01	Term work : 25 marks

Preamble:

Engineering is one of the important and cultured professions. With respect to any engineering profession, engineers are expected to exhibit the reasonable standards of integrity and honesty. Engineering is directly or indirectly responsible to create a vital impact on the quality of life for the society. Acceptably, the services provided by engineers require impartiality, honesty, equity and fairness and must give paramount importance to the protection of the public health, safety, and welfare. Engineers must perform under a standard of professional behavior that requires adherence to the principles of ethical conduct.
Prime aim is to recognize and evaluate ethical challenges that they will face in their professional careers through knowledge and exercises that deeply challenge their decision making processes and ethics.

Course Objectives:

1. To promote ethics, honesty and professionalism.
2. To set standards that are expected to follow and to be aware that If one acts unethically what are the consequences.
3. To provide basic knowledge about engineering Ethics, Variety of moral issues and Moral dilemmas, Professional Ideals and Virtues
4. To provide basic familiarity about Engineers as responsible Experimenters, Research Ethics, Codes of Ethics, Industrial Standards, Exposure to Safety and Risk, Risk Benefit Analysis
5. To have an idea about the Collegiality and Loyalty, Collective Bargaining, Confidentiality, Occupational Crime, Professional, Employee, Intellectual Property Rights.

Course Outcomes:

On completion of the course, students will be able to–

CO1: Understand the basic perception of profession, professional ethics, various moral and social issues, industrial standards, code of ethics and role of professional ethics in engineering field.

CO2: Aware of professional rights and responsibilities of an engineer, responsibilities of an engineer for safety and risk benefit analysis.

CO3: Understand the impact of the professional Engineering solutions in societal and Environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

CO4: Acquire knowledge about various roles of engineers in variety of global issues and able to apply ethical principles to resolve situations that arise in their professional lives.

COURSE CONTENTS

The following are the certain guidelines as far as ethics and code of conduct are concerned to be clearly and elaborately explained to the students,

Fundamental norms Engineers, in the fulfillment of their professional duties, should include paying utmost attention to the safety, health, and welfare of the society. Along with that engineers should execute the services only in their areas of competence. Whenever there is a need to issue public statements then such statements should be expressed in objective and truthful manner. Engineer should extend high sense of integrity by acting for each employer or client as faithful agents or trustees. Whatever may be the working scope engineer should conduct themselves honorably, responsibly, ethically, and lawfully so as to enhance the honor, reputation, and usefulness of the profession.

As far as ethical practices are concerned engineers should not reveal facts, data, or information without the prior consent of the client or employer except as authorized or required by law or Code. Engineers should not permit the use of their name or associate in business ventures with any person or firm that they believe is engaged in fraudulent or dishonest enterprise moreover he/she should not aid or abet the unlawful practice of engineering by a person or firm.

Engineers having knowledge of any alleged violation of the Code should report thereon to appropriate professional bodies and, when relevant, also to public authorities, and cooperate with the proper authorities in furnishing such information or assistance as may be required. Engineers should disclose all known or potential conflicts of interest that could influence or appear to influence their judgment or the quality of their services. Engineers should not accept compensation, financial or otherwise, from more than one party for services on the same project, or for services pertaining to the same project, unless the circumstances are fully disclosed and agreed to by all interested parties. Engineers should not solicit or accept financial or other valuable consideration, directly or indirectly, from outside agents in connection with the work for which they are responsible.

Engineers should never falsify their qualifications or permit misrepresentation of their or their associates' qualifications. They shall not misrepresent or exaggerate their responsibility in or for the subject matter of prior assignments. Brochures or other presentations incident to the solicitation of employment shall not misrepresent pertinent facts concerning employers, employees, associates, joint ventures, or past accomplishments.

Engineers should not offer, give, solicit, or receive, either directly or indirectly, any contribution to influence the award of a contract by public authority, or which may be reasonably construed by the public as having the effect or intent of influencing the awarding of a contract. They should not offer any gift or other valuable consideration in order to secure work. They should not pay a commission, percentage, or brokerage fee in order to secure work, except to a bona fide employee or bona fide established commercial or marketing agencies retained by them. There are certain obligations accompanied with engineering profession. Engineers should acknowledge their errors and should not distort or alter the facts. Candid advises in special cases are always welcome. Engineers should not accept outside employment to the detriment of their regular work or interest. Before accepting any outside engineering employment, they will notify their employers.

Engineers should not promote their own interest at the expense of the dignity and integrity of the profession furthermore they should treat all persons with dignity, respect, fairness, and without

discrimination. Engineers should at all times strive to serve the public interest. Engineers are encouraged to participate in civic affairs; career guidance for youths; and work for the advancement of the safety, health, and well-being of their community. Engineers are encouraged to adhere to the principles of sustainable development in order to protect the environment for future generations. Engineers shall continue their professional development throughout their careers and should keep current in their specialty fields by engaging in professional practice, participating in continuing education courses, reading in the technical literature, and attending professional meetings and seminar.

Engineers should not, without consent, use equipment, supplies, laboratory, or office facilities of an employer to carry on outside private practice. They should not attempt to injure, maliciously or falsely, directly or indirectly, the professional reputation, prospects, practice, or employment of other engineers. Engineers who believe others are guilty of unethical or illegal practice shall present such information to the proper authority for action. "Sustainable development" is the challenge for the engineers meeting human needs for natural resources, industrial products, energy, food, transportation, shelter, and effective waste management while conserving and protecting environmental quality and the natural resource base essential for future development.

Following are contents to be covered in tutorial session-

1. **Introduction to Ethical Reasoning and Engineer Ethics:** Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas –Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy –Professions and Professionalism – Professional Ideals and Virtues – Uses of Ethical Theories.
2. **Professional Practice in Engineering :** Global Issues -Multinational Corporations – Business Ethics - Environmental Ethics – Computer Ethics - Role in Technological Development – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Code of Conduct.
3. **Ethics as Design - Doing Justice to Moral Problems :** Engineer's Responsibility for Safety - Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis – Reducing Risk – The Government Regulator's Approach to Risk.
4. **Workplace Responsibilities and Rights -** Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.
5. **Computers, Software, and Digital Information**
6. **Responsibility for the Environment**

#Exemplar/Case Studies :

General Motors ignition switch recalls (2014), Space Shuttle Columbia disaster (2003), Space Shuttle Challenger disaster (1986), Therac-25 accidents (1985 to 1987), Chernobyl disaster (1986),Bhopal disaster (1984), Kansas City Hyatt Regency walkway collapse (1981).

Guidelines for Conduction
The course will exemplify the budding engineers the Code of Conduct and ethics pertaining to their area and scope of their work. The Instructor/Teacher shall explain the students the importance and impact of the ethics and code of conduct. Confined to various courses and project/mini-project development the possible vulnerabilities and threats need to be elaborated and the students' participation need to be encouraged in designing such document explicitly mentioning Code of Conduct and Disclaimers.
Suggested set of Activities
1. Purpose-Introduce the concept of Professional Code of Conduct. **Method** – Using Group Discussion as a platform, ask students to share one practice in their family / home that everyone has to follow. For ex. not wearing footwear in the house, taking a bath first thing in the morning, seeking blessings from elders, etc. Connect this Code of Conduct in their family to one that exists in the professional world **Outcome** – Awareness of profession-specific code of conduct and importance of adherence of that code specified. Ability to express opinions verbally and be empathetic to diverse backgrounds and values **2. Purpose-Impress upon the students, the significance of morality** **Method –** Role play a professional situation where an engineer is not competent and is trying to copy the work of a colleague and claim credit for that work. Ask observing students to react to that situation. Alternatively, a short video that clearly shows unethical behavior can be played and ask viewers their opinion about the situation. Note to teachers – read about Kohlber's theory and Gilligan's theory to understand levels of moral behavior. **Outcome** – Incite students to contemplate their own immoral behavior in public space or academic environment (like copying homework or assignment). Will coax students to introspect their own values and encourage them to choose the right path. **3. Purpose**-Highlight the importance of professional ideals like conflict management, ambition, ethical manners and accountability. **Method –** Each student will have to write a 200 word essay on any of above mentioned virtues of being a good professional. On evaluation, the top 5 essays can be displayed on the college wall magazine and rewarded if deemed appropriate. **Outcome –** Learn to express one's ideas and identify and relate to good virtues. Build writing skills, improve language and gain knowledge about how to write an impactful essay. **4. Purpose**-Make students aware of proper and globally accepted ethical way to handle work, colleagues and clients **Method** – Teacher can form groups of 6 – 7 students and assign them different cases (these can be accessed online from copyright free websites of B-school content) **Outcome** – Develop group communication skills. Learn to speak up one's opinion in a forum. Cultivate the habit of presenting solution-driven analytical arguments making them contributors in any team.

5. Purpose – Make students aware that technology can be harmful if not used wisely and ethically.
Method – Conduct a quiz on various ethical dilemmas that are relevant in today's world pertaining to privacy right, stalking, plagiarism, hacking, weaponizing technology, AI, electronic garbage creating environmental hazard etc
Outcome – Make students aware of various adverse consequences of technology development and allow them to introspect on how to use technology responsibly.

6. Purpose – Expose students to professional situations where engineers must use their skills ethically and for the betterment of society and nation
Method – Students in groups of 4 can be given an assignment in the earlier session to present in front of the class one specific case where they felt unethical treatment has been meted out to a person by an engineer – either as a witness, advisor, dishonesty, improper skills testimony etc. The group has to make a short presentation and also suggested plausible solutions to that situation. Q&A from other students must encouraged to allow healthy discussion
Outcome – Become aware of unethical code of conduct in the professional world and how to follow a moral compass especially when one reaches positions of power.

7. **Purpose** – Provide an insight into rights and ethical behavior.
Method – Movies like The Social Network can be played and students can be asked to discuss their opinion about collegiality, intellectual property, friendship and professional relationships
Outcome – help them look at success stories from an ethical point of view. Develop critical thinking and evaluation of circumstances.

8. Purpose – Make students contemplate about ideal and safe professional environment and decide on making right decisions based on codes of conduct
Method – Students can be asked to write down 5 most important codes of conduct that they feel that every computer engineer should follow. After evaluation by teacher / experts, the collection of codes can be converted into a handbook to be given to every student as a memoir to help them in their professional life.
Outcome – Introspection and think about how to shape the professional environment. Also, when they carry back with them their own codes of conduct, they could feel bound to adhere to these ethics.

Term Work Assessment Guidelines

Students must submit the report of all conducted activities. Conducted during Tutorial (Outside Classroom) of at least 04 activities (out of 07 activities) from group (of 02-03) students.

The brief guidelines for report preparations are as follows:

1. One activity report must be of maximum 3 pages;
2. Combined Report of all activities with cover pages, table of contents and certificate (signed by instructor) is to be submitted in soft copy (pdf) format only.

3. The report must contain:

- General information about the activity;
- Define the purpose of the activity;
- Detail out the activities carried out during the visit in chronological order;
- Summarize the operations / process (methods) during the activities;
- Describe what you learned (outcomes) during the activities as a student;
- Add photos of the activity;(optional)
- Add a title page to the beginning of your report;
- Write in clear and objective language; and
- Get well presented, timely and complete report submitted.

Recommended Assessment and Weightage Parameters:
(Attendance 30%, Assignments/Activities- Active participation and proactive learning 50% and report 20%)

Web Links:

- https://www.ieee.org/about/compliance.html
- https://www.cs.cmu.edu/~bmclaren/ethics/caseframes/91-7.html
- https://www.nspe.org/
- http://www.ewh.ieee.org/soc/pes/switchgear/presentations/tp_files/2017-1_Thurs_Shiffbauer_Singer_Engineering_Ethics.pdf

MOOC/ Video lectures available at:

https://swayam.gov.in/nd1_noc20_mg44/preview

Home

Savitribai Phule Pune University, Pune
Second Year Artificial Intelligence & Machine Learning (2020 Course)
218561 (A) : Mandatory Audit course 4:
Water Supply and Management

Teaching Scheme:	Credit Scheme:	Examination Scheme:
01hrs/week	Non Credit	Audit Course

Prerequisite Courses: Basic knowledge of environmental science and mathematics

Course Objectives:

1. Enable the student to understand the various components of environment in and around the earth crust and understand the effects of it over plants, animals, etc
2. Understand the important concepts of good water supply system to a city/town or a village
3. Understand the need of conservation of rain water and its applications
4. Understand the sources, effects, prevention and control measures of water pollution and its legislative aspects.

Course Outcomes:

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

CO1: Relate the relations between the environment and ecology, estimating water requirement for public water supply scheme.

CO2: Assess the quality of water as per BIS and select the appropriate treatment method required for the water source.

CO3: Analyze the suitable distribution system for a locality and know the appurtenances used.

CO4: Summarize the arrangement of water supply and fittings in a building.

CO5: Determine the need of conservation of water and rural water supply.

CO6: Identify the sources of water pollution and suitable control measures.

COURSE CONTENTS

Unit I	Introduction To Environment, Water Requirement And Water Sources	02 hrs

ENVIRONMENT AND ECOLOGY: Atmosphere, Lithosphere, Hydrosphere, Biosphere. Relation between Plant, Animals and Environment. Eco System, Man and Ecology.

WATER REQUIREMENT: Necessity of water supply, Methods of population forecasting (Arithmetical, Geometrical and Incremental Increase method), Water Requirements for a) Domestic Purpose b) Industrial Use c) Fire Fighting d) Public Purpose e) Losses. Per Capita Demand and Factors affecting it. Total Quantity of Water Required for a Town.

SOURCES OF WATER: Surface Sources - Lakes, Streams, Rivers. Impounded Reservoirs. Underground Sources - Infiltration Galleries, Infiltration Wells and Springs

Mapping of Course Outcomes for Unit I	CO1

Unit II	Quality And Treatment Of Water	02 hrs

QUALITY OF WATER: Impurities of water - organic and inorganic classification and examination of water. Physical - temperature, color, turbidity, taste and odour. Chemical - pH Value, Total Solids, Hardness, Chlorides, Iron and Manganese, Fluoride and Dissolved Oxygen. Bacteriological- E-coli, Most Probable Number (MPN), Quality Standards for Domestic purpose as perBIS.

TREATMENT OF WATER: Flow diagram of different units of treatment, brief description of constructional details, working and operation of the following units - plain sedimentation, sedimentation with coagulation, flocculation, filtration-Slow sand filters, Rapid sand filters and pressure filters (nodesign) Disinfection of water, Chlorination		
Mapping of Course Outcomes for Unit II	**CO2**	
Unit III	**Water Distribution System**	**02 hrs**
DISTRIBUTION SYSTEM: General Requirements, Systems of Distribution- Gravity System, Combined System, Direct Pumping. Maintenance of required pressure in Distribution Systems. Storage- Underground, Ground Level And OverheadServiceReservoirs– Sketch,NecessityandAccessories.Typesoflay- out : dead end, grid iron, radial and ring systems, their merits and demerits and their suitability **APPURTENANCES IN DISTRIBUTION SYSTEM:** Use of Sluice Valves, Check Valves, Air Valves, Scour Valves, Zero Velocity Valves, Fire Hydrants, Water Meter		
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**Water Supply In Buildings**	**02 hrs**
Water Supply arrangement in Buildings: General lay-outofwatersupplyarrangementforsingleandmulti-storiedbuildingsasperB.I.S code of practice. Pipe Materials- Plastic Pipes, High Density Polythene Pipes, Densified cast iron pipes, Merits and Demerits. Connections from water main to buildings. Water supply fittings - their description and uses, water main, service pipes, supply pipe, distribution pipe, domestic storage tank, stop cock, ferrule, goose neck, water tap, Modern systems of Potable water purification-(RO, UV, Activated carbon), Hot water supply - electric and solar waterheaters.		
Mapping of Course Outcomes for Unit IV	**CO4**	
Unit V	**Water Conservation**	**02hrs**
WATER CONSERVATION: Conservation of rain water, roof water harvesting, recharging of ground water. RURAL WATER SUPPLY: Rural water supply systems, Disinfection of well water.		
Case Studies:	Refer suggested list of Case studies/ Students activities	
Mapping of Course Outcomes for Unit V	**CO5**	
Unit VI	**Water Pollution And Pollution control**	**02 hrs**
WATER POLLUTION AND CONTROL: Sources of water pollution, types and its effects, Prevention and control measures of water pollution, Legal aspects regarding water pollution control.		

Mapping of Course Outcomes for Unit V	**CO6**

Reference Books :

1. S.K.Garg, Water Supply Engineering Vol-I, Khanna Publishers
2. G.S.Birdie,Water Supply & Sanitary Engineering-including Environmental Engineering, water And air pollution and Ecology, Dhanpat RaiandSons publishers,ISBN:81-87433-31-0
3. Dr. P.N. Modi, Environmental Engg.-Vol-I, Standard BookHouse
4. A.K.Chatterji,WaterSupply,WasteDisposalandEnvironmentalPollution Engineering, Khanna publishers

SUGGESTED LIST OF CASE STUDIES/STUDENTACTIVITIES

1. Collect the information about biotic and a biotic component of surrounding environment and frame relation among them
2. Estimatethetotalquantityofwaterrequiredforatown/locality/Institute
3. Prepare map and written report for surface and underground sources of water in the neighborhood
4. Visit nearby Certified Water testing laboratories and identify various tests conducted on water
5. Visit Water Treatment Plant and collect details of unit operations and processes involved in it.
6. Study the distribution system of water supply of your locality
7. Visit a newly constructed building and study plumbing work
8. Study a rooftop rain water harvesting system of existing building
9. Study a Solar water heating system and collect necessary data
10. Collect a necessary data/information about issues related to water pollution and Prepare report/presentation

Evaluation:

Students should select any one of the above topic in a group of 3 to 5. Students should submit a written report and make a presentation on the topic. The task should not be repeated among students. Report will be evaluated by the faculty as per rubrics defined by him/her/them at start of course.

Home

Savitribai Phule Pune University, Pune
Second Year Artificial Intelligence & Machine Learning (2020 Course)
218561 (B): Mandatory Audit course 4 :
Language Study Japanese : Module - II

Teaching Scheme:	Credit Scheme:	Examination Scheme:
01hrs/week	Non Credit	Audit Course

Prerequisite Courses: Audit Course 3**:** Language Study Japanese: Module-I

Course Objectives :

1. To develop the Japanese communicative competence of students with small sentence formation.to make primitive social conversation in Japanese.
2. To enable students with comprehension ability of Japanese grammar.
3. To enable students to translate simple conversations from English to Japanese and vice a versa.
4. To make students aware about Japanese Culture and Customs.

Course Outcomes :

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

CO1: Have Japanese Communicative competence for primitive Social conversation in Japanese

CO2: Comprehend Grammar of Japanese Script

CO3: Translate simple sentences from Japanese to English and vice a versa

CO4: Be aware about Japanese society and people

COURSE CONTENTS

Unit I	Japanese Conversation	(02 hrs +04hrs Self Study)

Oral practice of conversation in situations such as declining an invitation, reporting an event, narrating a story, short formal speeches on occasions such as welcoming, introducing and thanking a guest, talking about Japanese and Indian festivals, hostel life etc

Mapping of Course Outcomes for Unit I	CO1

Unit II	Japanese Text and Kanji	(02hrs +04 hrs Self Study)

Diverse texts based on Japanese culture, customs, history, food habits, and science etc, for the development of communicative competence of students; skimming, scanning of texts with emphasis on advanced sentence patterns, grammatical structures and idiomatic phrases, reading and writing of approximately 400 *kanji*.

Mapping of Course Outcomes for Unit II	CO2,CO3

Unit III	Japanese Grammar and Composition	(02 hrs +04 hrs Self Study)

Basic sentence patterns to be applied in self-introduction, identifying things; time of the day; calendar; counting using Japanese numerical classifiers; describing things; making comparisons; talking of daily activities; kinship terms used for address and reference; seasons; giving and receiving; shopping; making requests; talking of one's likes and dislikes

Mapping of Course Outcomes for Unit III	**CO2, CO3**	
Unit IV	**Japanese – English Translation**	**(02hrs +04 hrs Self Study)**
Practice in English to Japanese and Japanese to English translation of short passages on various topics such as culture, society, religion and life style taken from books, newspapers, magazines, internet etc.		
Mapping of Course Outcomes for Unit IV	**CO3**	
Unit V	**Language and Literature of Japan**	**(02 hrs.)**
History of Japanese language, literary trends, religions, spread of Chinese influence, development of art and culture in Japan.		
Mapping of Course Outcomes for Unit V	**CO4**	

E-Resources for Learning Support:

1. https://www.duolingo.com/course/ja/en/Learn-Japanese
2. https://www.freejapaneselessons.com/
3. https://minato-jf.jp/(Japan Foundation)

Text Books:

1. EriBanno, Genki I: An Integrated Course in Elementary Japanese , 3rd Edition 2020, The Japan Times, (ISBN13: 9784789017305)
2. George Trombley , Yukari Takenaka, Japanese From Zero, 6th Edition, Learn From Zero Publishers (ISBN10- 0976998122, ISBN13-9780976998129)
3. Tae Kim, A Guide to Japanese Grammar, 2012, CreateSpace Publishing, (ISBN-1469968142, ISBN13- 9781469968148) http://www.guidetojapanese.org/learn/grammar

Reference Books:

1. Yukiko Ogata, Kana Sumitani, Yasuko Hidari, Yukiko Watanabe, Nihongo fun and Easy -II, Basic Grammar for Conversation
2. Nobuo Akiyama, Carol Akiyama, Japanese Grammar (Barron's Grammar), 3rd edition 2012, Barrons Educational Series
3. Storry Richard, A History Of Modern Japan, 1973, Penguin Books Ltd,
4. James W. Heisig, Remembering the Kanji 1 : A Complete Course on How Not To Forget the Meaning and Writing of Japanese Characters, 6h Edition, University of Hawai'i Press (ISBN10-0824835921, ISBN13-9780824835927)

Evaluation:

Students should select any one of the above topic in a group of 3 to 5. Students should submit a written report and make a presentation on the topic. The task should not be repeated among students. Report will be evaluated by the faculty as per rubrics defined by him/her/them at start of course.

Home

Savitribai Phule Pune University, Pune
Second Year Artificial Intelligence & Machine Learning (2020 Course)
218561 (C): Mandatory Audit course 4 :
e-Waste Management and Pollution Control

Teaching Scheme:	Credit Scheme:	Examination Scheme:
01hrs/week	Non Credit course	Audit Course

Prerequisite Courses: if any: --

Course Objectives :

1. To make the students aware about importance of environmental study.
2. To study impact of professional engineering products in societal contexts.
3. To understand impact of professional engineering products in environmental contexts.
4. To learn e-waste management and e-waste recycling process.
5. To understand causes, effects and control measures of environment pollutions.
6. To learn impact of environment controlling methods on human health.

Course Outcomes :

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

CO1: Discuss various types of e-waste sources.
CO2: Understand impact of various e-wastes.
CO3: Identify characteristics of various e-Waste pollutants.
CO4: Understand process of e-Waste Recycling and relevant technologies.
CO5: Discuss causes, effects and control measures of different environment pollution.
CO6: Demonstrate Safe methods for disposal of e-waste and controlling the pollution.

COURSE CONTENTS

Unit I	E-Waste Overview and Sources	02 hrs

e-waste Overview: What is e-waste, E-waste growth- An overview, hazards of e-waste **Sources of e-wastes:** Discarded computers, televisions. VCRs. stereos, copiers, fax machines, electric lamps, cell phones, audio equipment and batteries if improperly disposed.

Mapping of Course Outcomes for Unit I	CO1

Unit II	Impact of various e-wastes	02 hrs

Solder in printed circuit boards, glass panels and monitors, Chip resistors and semiconductors, Relays and switches, Printed Circuit Boards, Cabling and computer housing, Plastic housing of electronic equipment and circuit boards, Front panel of CRTs, Motherboards.

Mapping of Course Outcomes for Unit II	CO2

Unit III	E- Waste pollutants and Characteristics	02 hrs

Digital dump yard, how to minimize e-waste, Hazardous substances waste Electrical and

Electronic Equipment, characteristics of pollutants, batteries, electrical and electronic components, plastic and flame retardants, circuit boards, pollutants in waste electrical and electronic equipment.		
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**E-Waste Recycling**	**02 hrs**
Overview of e-Waste recycling, Technologies for recovery of resources from electronic waste, resource recovery potential of e-waste, steps in recycling and recovery of materials-mechanical processing, technologies for recovery of materials		
Mapping of Course Outcomes for Unit IV	**CO4**	
Unit V	**Environmental Pollution**	**02 hrs**
Causes and effects and control measures of: Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, nuclear hazards, Role of an individual in prevention of pollution, Pollution case studies: Pollution caused because of electronic waste material and measures for controlling.		
Mapping of Course Outcomes for Unit V	**CO5**	
Unit VI	**Impact on human health and Pollution Controlling**	**02 hrs**
Impact of products from e-waste in human health, Current disposal methods of e-waste, e-waste recycling technologies and methods recycling pose a risk to environmental and human health. Safe methods for disposal of e-waste and controlling relevant pollution.		
Mapping of Course Outcomes for Unit VI	**CO6**	

E-Resources from Learning Support

1.https://nptel.ac.in/courses/105/105/105105169/
2.https://www.ugc.ac.in/oldpdf/modelcurriculum/env.pdf

Text Books

1. E-Waste Managing the Digital Dump Yard, Edited by Vishakha Munshi,ICFAI University Press,2007.
2. Text Book of Environmental Studies for undergraduate Courses by Bharucha Erach,University Press, II- Edition 2013 Available online free edition.

Reference Books

1. E-waste: Implications, Regulations and Management in India and Current Global Best Practices, Edited by Rakesh Johri, The Energy and Resources Institute, New Delhi,2008

Evaluation:

Students should select any one of the above topic in a group of 3 to 5. Students should submit a written report and make a presentation on the topic. The task should not be repeated among students. Report will be evaluated by the faculty as per rubrics defined by him/her/them at start of

course.

Savitribai Phule Pune University, Pune
Second Year Artificial Intelligence & Machine Learning (2020 Course)
218561 (D): Mandatory Audit course 4 :
Intellectual Property Rights

Home

Teaching Scheme:	Credit Scheme:	Examination Scheme:
01hrs/week	Non Credit	Audit Course

Prerequisite Courses, if any: ---

Course Objectives

1. To introduce fundamental aspects of Intellectual property Rights (IPR)
2. To disseminate knowledge about types of IP like Patents, Copyrights, Trade Secrets
3. To make students aware about current trends in IPR and their importance
4. To motivate students for innovative thinking and making inventions

Course Outcomes

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

CO1: Exhibit the concepts of Intellectual Property Rights

CO2: Differentiate among different IPR

CO3: Formulate and characterize innovative ideas and inventions into IPR

CO4: Demonstrate knowledge of advances in patent law and IP regulations

COURSE CONTENTS

Unit I	Overview Of Intellectual Property	02 hrs
Introduction and the need for intellectual property right (IPR) - Types of Intellectual Property Rights: Patent, Copyright, Trade Mark, Design, Geographical Indication, Plant Varieties and Layout Design – Genetic Resources and Traditional Knowledge – Trade Secret.		
Mapping of Course Outcomes for Unit I	**CO1, CO2**	
Unit II	**Patents**	**04 hrs**
What is invention? Patentability criteria: Novelty, Non-Obviousness (Inventive Steps), Industrial Application, Non- Patentable Subject Matter, Patent Search, Patent Registration Procedure, Rights and Duties of Patentee, Assignment and license, Infringement.		
Mapping of Course Outcomes for Unit II	**CO3, CO4**	
Unit III	**Copyrights**	**02 hrs**
Concept of Copyright –Copyright Subject matter: original literary, dramatic, musical, artistic works; cinematograph films and sound recordings - Registration Procedure, Term of protection, Ownership of copyright, Assignment and license of copyright - Infringement		
Mapping of Course Outcomes for Unit III	**CO3**	

Unit IV	**Trademarks**	**02 hrs**
Nature of Trademarks - Different kinds of trademarks (, logos, signatures, symbols, well known marks, brand names, certification and service marks) – Trademarks that can't be registered–Trademarks registration procedure - Rights of holder and assignment and licensing of marks - Infringement		
Mapping of Course Outcomes for Unit IV	**CO3**	
Unit V	**Advances in IP Laws and Government policies**	**02 hrs**
Amendments and India`s New National IP Policy, Promoting IPR policy for Start-ups, Career Opportunities in IP - IPR in current scenario		
Mapping of Course Outcomes for Unit V	**CO4**	

Text Books

1. Niraja Pandey, Khush deep Dharni (2014), "Intellectual Property Rights", PHI
2. Nithyananda K V. (2019). Intellectual Property Rights: Protection and Management. India, IN: Cengage Learning India Private Limited

Reference Books

1. Mishra, "An introduction to Intellectual property Rights", Central Law Publications
2. Ahuja, V K. (2017). Law relating to Intellectual Property Rights. India, IN: Lexis Nexis

Evaluation:

Students should select any one of the above topic in a group of 3 to 5. Students should submit a written report and make a presentation on the topic. The task should not be repeated among students. Report will be evaluated by the faculty as per rubrics defined by him/her/them at start of course.