D. Y. Patil College of Engineering and Technology

Kasaba Bawada, Kolhapur

(An Autonomous Institute)

Accredited by NAAC with 'A' Grade

Structure and Syllabus of S.Y. B. Tech in CSE (Artificial Intelligence and Machine Learning)

Department of Computer Science and Engineering

2021-22

D Y Patil College of Engineering & Technology, Kasaba Bawada, Kolhapur
Department of Computer Science & Engineering
Curriculum Structure for B. Tech in CSE (Artificial Intelligence and Machine Learning)

Second Year B. Tech. Program in CSE (Artificial Intelligence and Machine Learning) Semester – III

Sr. No	Course Code	Course Type	Name of the Course	Teaching Scheme Per Week			Credits	Total Marks	Evaluation Scheme			
				Lecture Hours	Tutorial Hours	Practical Hours			Type	Max. Marks	Min. Marks for Passing	
1	201AIMLL201	BSC	Linear Algebra	3	-	-	3	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
2	201AIMLL202	BSC	Discrete Mathematics and Graph Theory	3	1	-	4	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
3	201AIMLL203	ESC	Computer Architeture and Microprocessors	3	-	-	3	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
4	201AIMLL204	PCC	Data Structures	3	-	-	3	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
5	201AIMLL205	PCC	Fundamentals of Networking	3	-	-	3	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
6	201AIMLP206	PCC	Python Programming Laboratory	2	-	2	3	50	ISE	25	10	20
									ESE-POE	25	10	
7	201AIMLP207	PCC	Data Structure Laboratory	-	-	2	1	75	ISE	25	10	30
									ESE-POE	50	20	
8	201AIMLP208	PCC	Networking Laboratory	-	-	2	1	50	ISE	25	10	20
									ESE-OE	25	10	
9	201AIMLMC209	MC	Environmental Studies (Mandatory Course-I)	2	-	-	-	50	ESE	50	20	20
Total				19	1	6	21	725	-	-	-	290

ISE: In Semester Evaluation ***MSE: Mid Semester Examination*** ***ESE: End Semester Examination***

Note 1 : Tutorials and practical shall be conducted in batches with batch strength not exceeding 20 students.

Note 2 : ESE will be conducted for 100 marks and converted to 50 marks

Second Year B. Tech. Program in CSE (Artificial Intelligence and Machine Learning) Semester – IV

Sr. No	Course Code	Course Type	Name of the Course	Teaching Scheme Per Week			Credits	Total Marks	Evaluation Scheme			
				Lecture	Tutorial	Practical			Type	Max.	Min. Marks for	
1	201AIMLL210	BSC	Probability and Statistics	3	1	-	4	100	ISE MSE ESE	20 30 50	20 20	40
2	201AIMLL211	PCC	Operating Systems	3	-	-	3	100	ISE MSE ESE	20 30 50	20 20	40
3	201AIMLL212	PCC	Computer Algorithms	3	-	-	3	100	ISE MSE ESE	20 30 50	20 20	40
4	201AIMLL213	PCC	Fundatmentals of Artificial Intelligence	3	-	-	3	100	ISE MSE ESE	20 30 50	20 20	40
5	201AIMLL214	PCC	Formal Automata and Applications	3		-	3	100	ISE MSE ESE	20 30 50	20 20	40
6	201AIMLP215	PCC	R Programming Laboratory	2	-	2	3	50	ISE ESE-POE	25 25	10 10	20
7	201AIMLP216	PCC	Artificial Intelligence Laboratory	-	-	2	1	75	ISE ESE-POE	25 50	10 20	30
8	201AIMLP217	HMCS	Soft Skills Laboratory	-	-	2	1	50	ISE ESE-OE	25 25	10 10	20
9	201AIMLMC218	MC	Economics and Management for IT (Mandatory Course-II)	2	-	-	-	50	ESE	50	20	20
Total				19	1	6	21	725	-	-	-	290

ISE: In Semester Evaluation ***MSE: Mid Semester Examination*** ***ESE: End Semester Examination***

Note 1 : Tutorials and practical shall be conducted in batches with batch strength not exceeding 20 students.

Note 2 : ESE will be conducted for 100 marks and converted to 50 marks.

***** 4 to 6 weeks Internship is mandatory in summer vacation of SEM-IV or SEM-VI (Credits will be considered in VII semester)**

Course Plan

Course Title: Linear Algebra	
Course Code:201AIMLL201	**Semester: III**
Teaching Scheme: L-T-P: 3-0-0	**Credits: 3**
Evaluation Scheme: ISE +MSE Marks: 20+30	**ESE Marks:50**

Course Objectives:

1. To understand basic concepts of linear algebra to illustrate its power and utility through applications to computer science and engineering.
2. To apply the concepts of vector spaces, linear transformations, matrices and inner product spaces in engineering.
3. To understand the fundamentals of fuzzy logic.

Course Outcomes COs:

At the end of this course students will be able to

C201.1	Calculate base and dimension of vector spaces
C201.2	Recognize and use basic properties of subspace and vector space.
C201.3	Interpret the properties of vector spaces and subspces using linear trnsformations
C201.4	Determine the orthogonality in inner product space with the properties of inner product space
C201.5	Explain the fundamental concepts of fuzzy sets, knowledge representation of fuzzy rules and fuzzy logics.
C201.6	Apply arithmetic operations on fuzzy numbers, Addition and Multiplication

Prerequisite	Set Theory, Matrix, Eigen Values and Eigen Vectors

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C201.1	3	2	-	-	2	-	-	-	-	-	-	-	-	-	3
C201.2	3	2	-	-	2	-	-	-	-	-	-	2	-	-	3
C201.3	3	2	-	-	2	-	-	-	-	-	-	2	-	-	3
C201.4	3	2	-	-	2	-	-	-	-	-	-	-	1	-	3
C201.5	3	2	-	-	2	-	-	-	-	-	-	-	-	-	3
C201.6	3	2	-	-	2	-	-	-	-	-	-	-	-	-	3

Contents	Hours.
Unit 1 Vector Spaces The Euclidean space and vector space, subspace, linear combination, span, linearly dependent, independent, bases, dimensions, finite dimensional vector space.	**06**
Unit 2 Subspace Properties Row and column spaces, rank and nullity, bases for subspace, invertibility, application in interpolation.	**06**
Unit 3 Linear Transformations and applications Linear transformations, basic properties, invertible linear transformation, matrices of linear transformations, vector space of linear transformations, change of bases.	**06**
Unit 4 Inner Product Spaces Dot products and inner products, the lengths and angles of vectors, matrix representations of inner products, Gram-Schmidt orthogonalization, applications of inner product spaces-QR factorization, projection, orthogonal projections.	**06**
Unit 5 Introduction to Fuzzy sets Crisp set and Fuzzy set, basic concepts of fuzzy sets, basic operations on fuzzy sets, properties of fuzzy sets.	**06**
Unit 6 Fuzzy Arithmetic Fuzzy numbers, fuzzy cardinality, arithmetic operations on fuzzy numbers, solutions of fuzzy equations of type A + X = B and A.X = B.	**06**

Text Books:

1. Linear Algebra, Jin Ho Kwak and Sungpyo Hong, Second edition Springer(2004).(Unit- 1,2, 3,4)
2. Introductory Linear Algebra- An applied first course, Bernard Kolman and David, R.Hill, 9th Edition Pearson Education, 2011.
3. Fuzzy Sets and Fuzzy Logic: Theory and Applications, by George J. Klir and Bo Yuan (Unit-5, 6)

Reference Books:

1. Elementary Linear Algebra, Stephen Andrilli and David Hecker, 5th Edition,Academic Press(2016)
2. Applied Abstract Algebra, Rudolf Lidl, GuterPilz, 2nd Edition, Springer 2004.
3. Contemporary linear algebra, Howard Anton, Robert C Busby, Wiley 2003.
4. Introduction to Linear Algebra, Gilbert Strang, 5th Edition, Cengage Learning (2015).

Course Plan

Course Title: Discrete Mathematics and Graph Theory	
Course Code: 201AIMLL202	**Semester: III**
Teaching Scheme: L-T-P: 3-1-0	**Credits: 4**
Evaluation Scheme: ISE + MSE Marks: 20 + 30	**ESE Marks: 50**

Course Description:

The objective of this course is to teach students how to think logically and mathematically. The course stresses on mathematical reasoning and describes different ways in which mathematical problems could be solved. This Course consists of concepts of Discrete Mathematical Structures such as Set Theory, Algebraic systems, Lattices &Probability. The course also aims the study of Graphs, its basics & applications.

Course Objectives:

1. To develop logical thinking and its application to computer science.
2. To understand Relations & Functions.
3. To expose the students to the concepts of Lattices.
4. To introduce basic concepts of Graph and its Applications.
5. To understand the concepts of Permutations, Combinations, Probability &Discrete Random Variables.

Course Outcomes (COs):

At the end of the course the student should be able to:

C202.1	Write an argument using logical notation and determine if the argument is valid or invalid.
C202.2	Identify different types of binary relations on the basis of its properties.
C202.3	Identify the appropriate lattice and minimize the Boolean function.
C202.4	Understand Graph Theory and apply it to computer science application.
C202.5	Solve the problems using Permutations, Combinations, and Probability & learn concepts of Discrete Random Variables.

Prerequisite:	Mathematics - Probability theory, Set theory.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C202.1	2	-	1	-	-	-	-	-	-	-	-	1	-	-	5
C202.2	2	-	-	-	-	-	-	-	-	-	-	1	1	-	3
C202.3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	1
C202.4	2	-	-	-	1	-	-	-	-	-	-	-	2	-	3
C202.5	2	-	-	-	-	-	-	-	-	-	-	1	-	-	3

Content	Hours
Unit 1: Mathematical logic Statements and Notations, Connectives – negation, Conjunction, disjunction, conditional, bi-conditional, Statement formulas and truth tables, well -formed formulas, Tautologies, Equivalence of formulas, Duality law, Tautological implications, functionally complete sets of connectives, other connective, Normal and principal normal forms, completely parenthesized infix and polish notations, Theory of Inference for statement calculus – validity using truth table, rules of inference.	9
Unit 2: Binary Relations & Functions Relation and ordering - properties of binary relations in a set, Relation matrix and the graph of a relation, Partition and Covering of set, Equivalence relations , Functions – types, composition of functions, Explicit & Implicit equations, function notation, Intervals, Function Domains & Ranges , Odd & Even Functions, Power Functions.	9
Unit 3: Lattices and Boolean algebra Partial ordering, POSET and Hasse diagram, Lattice as POSETs, definition, examples and properties, Lattice as algebraic systems, Special lattices. Boolean algebra definition and examples, Boolean functions, representation and minimization of Boolean functions.	6

Unit 4: Graphs & Matching's Introduction to Graph, Graph Terminology, Storage representation and manipulation of Graphs, PERT and related Techniques, Euler's Formula, Euler and Hamilton Paths , Non-Hamiltonian Planar Graphs ,Matching's and Coverings in Bipartite Graphs Perfect Matching's, Applications - The Personnel Assignment Problem, The Optimal Assignment Problem.	5
Unit 5.Permutations, Combinations and Probability Theory Random Experiments, Sample space & Events, Pigeon hole principle, Permutations and Combinations, Concept of Probability Discrete Probability, Conditional Probability.	6
Unit 6: Discrete Random Variables & Expectation Random variables & Expectation,linearity of Expectations, Jensen's Inequality,The Bernoulli & Binomial Random Variables	5

Text Books:

1. J.P.Tremblay & R.Manohar, "Discrete Mathematical Structures with Application to Computer Science", MGH International (Unit 1 to 3).
2. J.A.Bondy and U.S.R. Murty,"Graph Theory with Applications", North-Holland, 1976.(Unit 4).
3. C. L. Liu and D. P. Mohapatra, "Elements of Discrete Mathematics", SiE Edition, Tata McGraw-Hill, 2008, ISBN 10:0-07-066913-9.(Unit 5).
4. Michael Mitzenmacher, Eli Upfal, "Probability and Computing Randomized Algorithms & Probabilistic Analysis", Cambridge (Unit 6)

Reference Books:

1. Seymour Lipschutz, MarcLipson,"Discrete Mathematics", MGH Schaum's outlines.
2. Kenneth H. Rosen, "Discrete Mathematics and its Applications" AT&T Bell Labs (mhhe.com/rosen).
3. John Schiller, Murray R. Spigel ," Probability and Statistics" MGH, Schaum's outlines
4. J. M. Aldous. Graphs and Applications. Springer, LPE, 2007
5. Diestel, R. Graph Theory New York, NY: Springer-Verlag, 1997. ISBN: 3540261834.
6.MichaelBaron,"Probability and Statistics for Computer Scientists", Second Edition, CRC Press publication

Online Resources:

- https://nptel.ac.in/courses/111/107/111107058/
- https://nptel.ac.in/courses/106/106/106106094/
- https://nptel.ac.in/courses/106/106/106106183/

Term Work:

A]The tutorial session should consists of minimum 10-12 assignments .Out of which minimum 7 assignments will be based on the topics from unit no 1,2,3,5 , unsolved exercise problems from the text books 1].J.P.Tremblay& R.Manohar,"Discrete Mathematical Structures with Application to Computer Science" MGH International (Unit 1 to 3) and 2] C. L. Liu and D. P. Mohapatra, "Elements of Discrete Mathematics", SiE Edition, Tata McGraw-Hill, 2008, ISBN 10:0-07-066913-9.(Unit 5).And minimum 3-4 assignments related to solving the examples on any of the following topics :

a. Evaluation of graphs using PERT
b. Matching's and Coverings in Bipartite graphs
c. The Personnel Assignment Problem
d. The Optimal Assignment Problem.
e. Euler and Hamilton Paths Bridges
f. The Bernoulli & Binomial Random Variables

B] To write programs in C language on any 2 of the following related topics.

1. Generating truth table of a statement
2. Application of bit representation of sets and operations on sets or relations.
3. Conversion of polish expressions.
4. Obtaining the path matrix, paths of different lengths.
5. Allocation of graphs
6. PERT related techniques

Evaluation Guidelines:

1. ISE-I (10 Marks = 5 + 5)
   5 Marks will be based on first 5 Tutorial assignments.
   5 Marks will be based on activity conducted (quiz, case study, problem solving, pedagogy activity etc.) by the subject incharge.
   - ISE- I will be conducted before MSE

2. ISE –II (10 Marks = 5 + 5)
   5 Marks will be based on programming assignment
   5 Marks will be based on activity conducted (quiz, case study, problem solving, pedagogy activity etc.) by the subject incharge.
   - ISE- II will be conducted after MSE

Course Plan

Course Title: Computer Architecture and Microprocessors	
Course Code: 201AIMLL203	**Semester: III**
Teaching Scheme: L-T-P: 3-0-0	**Credits: 3**
Evaluation Scheme: ISE + MSE Marks: 20 + 30	**ESE Marks: 50**

Course Description:

Course covers various generations of computer system. Each major components of computer system like processor, memory, I/O devices, operations and organization is discussed in detail. To understand the design principles and implementation, Intel x86 architecture processor families is illustrated. Also system performance enhancement is discussed through multiprocessor and parallel processor environment.

Course Objectives:

1. To introduce various generations of computers, their working and basic architecture.
2. To make aware of basic organization of memory unit.
3. To provide a basic knowledge of multi-processor organization structures.
4. To provide an understanding of Architecture of Microprocessor &Microcontroller.
5. To introduce Pentium Processor family.

Course Outcomes (COs):

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

C203.1	Explain overview of computer structure and function.
C203.2	Solve a problem of memory design for given specification.
C203.3	Describe various techniques to increase system performance.
C203.4	Describe the architecture of Microprocessor & Microcontroller.
C203.5	Summarize the Pentium processor family with their architecture.

Prerequisite:	Computer and Programming, Fundamentals of Electrical and Electronics Engineering

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

Cos	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C203.1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2
C203.2	3	1	1	-	2	-	-	-	-	-	-	1	-	-	3
C203.3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2
C203.4	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2
C203.5	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2

Contents	Hours
Unit 1: Computer Evolution and Performance Organization and Architecture, Structure and Function, A Brief History of Computers, Evolution of Computers, Designing for Performance, The Evolution of the Intel x86 architecture.	5
Unit 2: The Computer System Computer Components, Computer Function, Bus Interconnection. **Cache Memory:** Cache Memory Principles, Elements of Cache Design, Pentium 4 and Power PC Cache Organization. **Types of Memory:** Internal Memory, External Memory: Optical memory **Input/Output:** External Devices, I/O Modules, Programmed I/O, Interrupt-Driven I/O, Direct Memory Access.	7
Unit 3: Serial/Parallel Organization **Central Processing Unit**: Processor Structure and Function: Processor Organization, Register Organization, Instruction Cycle, Instruction Pipelining. **Parallel Processing**: Multiple Processor Organization, Symmetric Multiprocessors.	6
Unit 4: Intel Microprocessor Architecture & Programming Architecture of 8085, The Microprocessor Based Personal Computer System Internal Microprocessor Architecture, Instruction execution in 8085, Classification of Instructions, Memory Addressing **CASE STUDY: Specification of Intel 8085 microprocessor**	7

Unit 5: Intel Microcontroller Introduction to 8051 Microcontrollers, Microcontroller Architecture, A single chip Microcontroller, Microprocessor Vs Microcontroller, 8/16 Bit Microcontrollers **CASE STUDY: Learning model of 8051 microcontroller.**	5
Unit 6: Advanced Microprocessors Introduction to Pentium Microprocessor, The memory System, Special Pentium Registers , Pentium Memory Management Introduction to Pentium Pro Microprocessor, Internal Structure of the Pentium Pro, The Memory System The Pentium 4 and Core2, Pentiumi3/i5/i7.	6

Text Books:

1. William Stallings, Computer Architecture and Organization, Pearson Education, 8th Edition, (2013), [UNIT 1, 2,3].
2. Barry B. Brey, The Intel Microprocessors: Architecture, Programming and Interfacing, Pearson Education Limited, 8th Edition (2009) [UNIT 4, 5 &6].
3. Ramesh Gaonkar, Microprocessor Architecture, programming and application with 8085, PENRAM International publishing, 6th Edition (1 Oct. 2013). [UNIT4].

Reference Books:

1. Carl Hamacher, ZvonkoVranesic and SafwatZaky, Computer Organization, Tata McGraw Hill, 5th Edition (January1980).
2. John P. Hayes, Computer Architecture and Organization, Tata McGraw Hill - (MGH), 3rd Edition (January2012).
3. Ramesh Gaonkar, Microprocessor Architecture, Programming and Applications with the 8085, PENRAM, 6th Edition (1 October 2003).
4. Douglas Hall, Microprocessors and Interfacing, Tata McGraw-Hill Education, (31 Dec. 1899).
5. John UffenBeck, The 8086/8088 Family: Design, Programming, and Interfacing, Pearson Publication, Hardcover Edition, (1 Oct.1986).

Online Resources:

1. https://nptel.ac.in/courses/106/105/106105163/
2. https://nptel.ac.in/courses/106/108/106108100/

Course Plan

Course Title : Data Structures	
Course Code : 201AIMLL204	**Semester : III**
Teaching Scheme : L-T-P : 3-0-0	**Credits : 3**
Evaluation Scheme : ISE + MSE Marks : 20 + 30	**ESE Marks : 50**

Course Description:

This course will introduce the fundamentals of data structures and will provide understanding of how to systematically organize data in a computer system. Also, includes topics which focus on searching and sorting techniques, linked list, tress and graphs. This course is helpful in many areas of electrical engineering, computational biology, computational finance etc. They are used in a variety of applications today including search engines (e.g., Google, Bing), social networking applications (e.g. Facebook, Twitter), embedded systems (e.g., cell phones, robots), and DNA analysis.

Course Objectives:

1. To make the students familiar with basic data structures
2. To select appropriate data structures in computer applications.
3. To provide the students with the details of implementation of various data structures.

Course Outcomes (COs):

At the end of the course the student should be able to:

C204.1	Understand the basic concepts and applications of data structures as well as algorithms that operate on them.
C204.2	Compare various data structures, searching and sorting techniques and recognize the advantages and disadvantages of them.
C204.3	Understand the details of implementation of various data structures.
C204.4	Select appropriate data structures, searching and sorting techniques in computer applications.

Prerequisite:	Basic knowledge of algorithms and C programming

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

Cos	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C204.1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	2
C204.2	-	2	-	-	-	-	-	-	-	-	-	-	-	-	2
C204.3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	2
C204.4	3	3	-	-	-	-	-	-	-	-	-	-	1	-	3

Content	Hours
Unit 1. Basic of Data Structures Data structure- Definition, Types of data structures, Data Structure Operations, Algorithms: Complexity, Time and Space complexity.	4
Unit 2. Searching and Sorting Techniques Linear search, Binary search, Sentinel search, Fibonacci search, Hashing – Definition, hash functions, Collision, Bubble sort, Selection sort, Insertion sort, Merge sort, Quick sort, Radix sort, Tim sort, Complexity and analysis.	7
Unit 3. Stacks and Queues Stack: Definition, operations, Array representation of stack, applications Queue: Definition, operations, Array representation of queue, applications, Circular queue, Priority queue, Deque.	7
Unit 4. Linked Lists Definition, representation, operations, implementation and applications of singly, doubly and circular linked lists. Linked representation of stack and Queue, Dynamic memory management, Memory efficient doubly linked list, unrolled Linked List,Skip List	6
Unit 5. Trees Terminology, representation, binary tree, traversal methods, binary search tree, XOR Tree, AVL search tree, B tree, B+ tree, Heaps- Operations and their applications, Heap sort.	8

Unit 6. Graphs Basic concept of graph theory, storage representation, graph traversal techniques- BFS and DFS, Graph representation using sparse matrix, Transpose of sparse matrix.	6

Text Books:

1. Seymour Lipschutz (MGH), Data Structures; McGraw Hill publications, Third Edition, [1 July 2017].
2. Alfred V. Aho, Jeffrey D. Ullman and John E. Hopcroft , Addison-Wesley Series, Data Structures and Algorithms; [1983].
3. Narasimha Karumanchi, Data Structure and Algorihmic Thinking with Python, CareerMonk Publication,[2016].

Reference Books:

1. Jean-Paul Tremblay, Paul. G. Soresan, “An introduction to data structures with Applications” - Tata Mc-Graw Hill International Editions, 2nd edition .
2. Richard F. Gilberg and Behrouz A., Data Structures- A Pseudo code Approach with C , 2nd Edition [15 Nov. 2007].
3. A. M. Tanenbaum, Y. Langsam, Data Structure using C; M. J. Augenstein, PHI publication, 2nd Edition, [1996].

Online Resources:

1. NPTEL videos: https://nptel.ac.in/courses/106/102/106102064/

Course Plan

Course Title: Fundamentals of Networking	
Course Code: 201AIMLL205	**Semester: III**
Teaching Scheme: L-T-P: 3-0-0	**Credits: 3**
Evaluation Scheme: ISE + MSE Marks: 20 + 30	**ESE Marks: 50**

Course Description:

This course provides a comprehensive introduction to computer networks and networking aspects which will be of help to all Computer Science Engineering Streams. Course includes computer networking fundamentals, network layered architectures, descriptive study of different layers of networking models, network protocols and tools.

Course Objectives:

1. To perceive fundamental concepts of Computer Networks.
2. To understand layered architecture and basic networking protocols.
3. To understand the Client server model &socketinterface.

Course Outcomes:

Upon successful completion of this course, the student will be able to –

C205.1	Describethe concepts of Computer Networks and Network layered architecture.
C205.2	Understand the protocols, algorithms and the addressing model used in networking.
C205.3	Demonstrate different networking protocols using socket programming.
C205.4	Understand the functionality of Domain Name System in networking.

Prerequisite:	Basic knowledge of computers

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

Cos	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C205.1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2
C205.2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2
C205.3	3	2	2	-	-	-	-	-	-	-	-	-	1	-	3
C205.4	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2

Content	Hours
Unit 1. Introduction to Computer Network: Overview of OSI layer Model and TCP/IP protocol model, Addressing,Underlying technologies for LANs, WANs, and Switched WANs	5
Unit 2. Data Link Layer: Design issues for Data Link Layers, framing methods, Error control: detection and correction, Flow control, Elementary Data Link protocols, Sliding window Protocols Go back n, Selective repeat.	6
Unit 3.Network Addressing: IPv4 Addresses: Classful Addressing Other Issues, Sub-netting and Super netting, Classless Addressing, Delivery, Forwarding and routing. IPv4: Datagram, Fragmentation, Options, Checksum. IPv6 Addressing: Introduction, IPv6 packet format: Base Header, Flow Label, Extension Headers, Transaction from IPV4 to IPV6,Comparison between IPv4 and IPv6.	7
Unit 4. Routing and Congestion Control techniques: Routing methods: shortest path, Link state, Distance vector routing and broadcast routing, Congestion control algorithms: Principles, Congestion prevention policies, congestion control in datagram subnet.	5

Unit 5. Transport Layer: The Transport service primitives, UDP: Process to Process communication, UserDatagram Format, Operation and uses of UDP.TCP: TCP Services and Features, TCP segment format, TCP Connections.	6
Unit 6. Application Layer: Principles of Network Applications: Network Application Architectures, Processes Communicating, Transport Services Available to Applications, Transport Services Provided by the Internet, Application-Layer Protocols. The Web and HTTP: Overview of HTTP, Non-Persistent and Persistent Connections, HTTP Message Format, Web Caching. FTP, TFTP. DNS—The Internet's Directory Service: Services Provided by DNS, Overview of How DNS Works, DNS Records and Messages. DHCP. Telnet. Socket Programming: Socket Programming with UDP, Socket Programming with TCP.	7

Text Books:

1. Behrouz A. Forouzan, TCP/IP protocol Suit, Tata Magraw .Hill, 4thEd. [Unit 1 – 5].
2. Kurose James F., Ross Keith W., Computer Networking: A Top-Down Approach, Sixth Edition, By Pearson. [Unit 6].

Reference Books:

1. Peter L Dordal, An Introduction to Computer Networks, Release 1.9.15.
2. Andrew S. Tanenbaum(PHI), Computer Networks
3. W. Richard Stevens (PHI), Unix Network Programming

Course Plan

Course Title: Python Programming Laboratory	
Course Code :201AIMLP206	**Semester: III**
Teaching Scheme: L-T-P: 2-0-2	**Credits :3**
Evaluation Scheme: ISE Marks:25	**ESE(POE) Marks:25**

Course Description:

Python is a high-level programming language that helps in developing a wide variety of applications, including web applications, network programming, graphical user interfaces (GUIs), scientific and numeric applications. It also has a strong community around machine learning, data modeling, data analysis and artificial intelligence (AI), with extensive resources and libraries built for these purpose.

Course Objective:

Sr. No.	Course Learning Objectives
1	Make the student learn basics of python programming language.
2	Expose the students to various data structures.
3	Make the students aware of various Object Oriented concepts.
4	Expose the students to advanced concepts in Python.

Course Outcomes (COs):

Cos	Course Outcomes
	Upon successful completion of the course, student will be able to…
C206.1	Summarize the basic concepts in python.
C206.2	Identify the data structures to solve a problem.
C206.3	Demonstrate the use of Object Oriented concepts in problem solving.
C206.4	Apply Python concepts in web application using Django framework.
C206.5	Use networking and multithreading concepts to solve a problem.

Prerequisite:	Knowledge of programming language like C/C++

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

Cos	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C206.1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2
C206.2	3	2	2	-	-	-	-	-	-	-	-	-	-	-	3
C206.3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	3
C206.4	2	-	-	-	2	-	-	-	-	-	-	-	-	-	3
C206.5	2	-	2	-	2	-	-	-	-	-	-	-	1	-	3

Content	Hours
Unit 1. Getting Started with Python: Basics of Python: Python Installation and Working of it, Data types in python, Operators in python, Input and Output,detail study of python blocks, control statements, Branching statements.	3
Unit 2.Basics of Python Programming: String and Character in python, List and Tuples, Dictionaries, Arrays in python, Functions.	5
Unit 3. OOP Concepts in Python: Classes and OOP Concepts: Procedural and Object-Oriented Programming, Objects, class, Method overloading, Polymorphism, Inheritance, hands on with Lamba function in python coding with the use of functions, modules and external packages.	4
Unit 4.Files in Python: Advanced Python:Files in Python, Directories, Building Modules, Packages, Text Processing, Regular expression in python.	5
Unit 5.Python Integration Primer: Graphical User interface, Networking in Python	4
Unit 6. Advanced Python: Introduction to Django, Introduction to Multithreading and security in Python.	3

Text books:

1. Beginning Python: Using Python 2.6 and Python 3.1.,Wrox Publication
2. Anurag Gupta, G. P. Biswas, Python Programming, McGraw-Hill
3. E. Balagurusamy, Introduction to computing and problem-solving using Python, McGraw Hill Education

Reference Books:

1. "Learn Python the Hard Way, 3rd Edition, Zed Shaw's Hard Way Series
2. Laura Cassell, Alan Gauld, "Python Projects", Wrox Publication

Online Resources:

1. https://nptel.ac.in/courses/106/106/106106182/

List of Experiments			
Expt. No.	**Name of Experiments**	**S/O**	**Hours**
1	Exploring basics of python like data types (strings, list, array, dictionaries, set, tuples)	O	2
2	Program for Implementation of control statements.	O	2
3	Creating functions, classes and objects using python. Demonstrate exception handling	O	2
4	Program for implementation of inheritance.	O	2
5	Python program to append data to existing file and then display the entire file	O	2
6	a. Python program to count number of lines, words and characters in a file. b. Python program to display file available in current directory	O	2
7	Creating Registration form GUI with Python.	O	2

8	Menu driven program to create a simple calculator.	O	2
9	Creation of simple socket for basic information exchange between server and client.	O	2
10	Creating web application using Django web framework to demonstrate functionality of user registration.	O	2
11	Programs on Threading using python.	O	2
12	Program to implement simple linear regression using Python	O	2

- **S-Study, O-Operational**

Note: Students should perform minimum 10-12 experiments based on above list

Text Books:

1. David Amos, Dan Bader, Joanna Jablonski, Fletcher Heisler “Python Basics: A Practical Introduction to Python 3”, Realpython
2. Samuel Dauzon, AidaisBendoraitia, ArunRavindran,”Django:Web Development with Python”.Packt>

Online Resources:

1. Virtual Lab:- https://python-iitk.vlabs.ac.in/
2. https://nptel.ac.in/courses/106/106/106106182/

Course Plan

Course Title : Data Structures Laboratory	
Course Code : 201AIMLP207	Semester : III
Teaching Scheme : L-T-P : 0-0-2	Credits : 1
Evaluation Scheme : ISE Marks : 25	ESE (POE) Marks: 50

Course Description:

The course is designed to develop skills to design and analyze simple linear and non linear data structures. It strengthen the ability to the students to identify and apply the suitable data structure for the given real world problem. It enables them to gain knowledge in practical applications of data structures.

Course Objectives:

1. To teach the students to identify appropriate data structures.
2. To provide the students with the details of implementation of various data structures.
3. To select appropriate data structures in computer applications.

Course Outcomes (COs):

At the end of the course the student should be able to:

C207.1	Outline the solution to the given software problem with appropriate data structure.
C207.2	Identify appropriate data structure for specific application.
C207.3	Formulate the problem statement and implement to solve that statement.
C207.4	Choose appropriate sorting & searching algorithms

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C207.1	3	3	-	-	-	-	-	-	-	-	-	-	-	-	2
C207.2	-	2	-	-	-	-	-	-	-	-	-	-	-	-	3
C207.3	-	3	3	-	2	-	-	-	-	-	-	-	1	-	3
C207.4	3	-	2	-	-	-	-	-	-	-	-	2	-	-	3

List of Assignments			
Ass. No.	**Name of Assignment**	**S/O**	**Hours**
1	Write a program to find an element in matrix using search technique.	O	2
2	Role play activity on searching techniques.	O	2
3	Programs to implement sorting techniques to sort an array of 0s, 1s and 2s.	O	2
4	Role play activity on sorting techniques.	O	2
5	Programs to implement stack using array and linked list.	O	2
6	Programs to implement queue using array and linked list.	O	2
7	Programs to implement various operations on linked list.	O	2
8	Programs to implement Memory efficient linked list.	O	2
9	Programs to implement BFS and DFS.	O	2
10	Case Study- 1. Garbage Collection. 2. Priority queue in bandwidth management. 3. Null Terminated or Cyclic Node. 4. Use of sparse matrix in Social Networks and Maps.	S	2

- **S-STUDY, O-OPERATIONAL**
- **Note: The instructor should take all ten experiments from list.**

Text Books:

1. Data Structures using C – Seymour Lipschutz (MGH), McGraw Hill publications, Revised 1st Edition. [1 July 2017]
2. C- A. M. Tanenbaum, Y. Langsam, M. J. Augenstein, Data Structure using; PHI publications, 2nd Edition, [2017].

Reference Books:

1. Ellis Horowitz, S. Sahni, D. Mehta, Fundamentals of Data Structures in C++, Galgotia Book Source, New Delhi 1995 ISBN 16782928.
2. Jean-Paul Tremblay, Paul. G. Soresan, An introduction to data structures with Applications, Tata Mc-Graw Hill International Editions, 2nd edition 1984, ISBN-0-07-462471-7.

Online Resources :

1. Virtual Lab: https://ds1-iiith.vlabs.ac.in/List%20of%20experiments.html
2. NPTEL videos: https://nptel.ac.in/courses/106/102/106102064/

Course Plan

Course Title: Networking Laboratory	
Course Code: 201AIMLP208	**Semester: III**
Teaching Scheme: L-T-P: 0-0-2	**Credits: 1**
Evaluation Scheme: ISE Marks: 25	**ESE (OE)Marks: 25**

Course Description:

This course provides a practical implementation of the computer networking theoretical aspects, studied during the lecture hours. Course includes computer networking fundamentals, demonstrations and implementation of network setup using networking tools &layered architectures, descriptive study of different layers of networking models, network protocols and algorithms.

Course Objectives:

1. To understand the fundamental concepts of Computer Networks.
2. To understand the different network connectivity and analyzing tools.
3. To implement the networking protocols and algorithms.
4. To implement the Client server model.

Course Outcomes:

Upon successful completion of this course, the student will be able to –

C208.1	Demonstrate use of Network Models and its Components.
C208.2	Implement the protocols and algorithms used in different layers of the network.
C208.3	Apply the principles of socket programming using TCP & UDP in the networks.
C208.4	Demonstrate the DNS and network analysing tools.

Prerequisite:	Basic knowledge of computers, C / C++ Programming Language, Linux, and Windows OS

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C208.1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	3
C208.2	2	1	2	2	-	-	-	-	-	-	-	-	-	-	3
C208.3	3	2	1	1	-	-	-	-	-	-	-	-	2	-	3
C208.4	3	1	-	1	-	-	-	-	-	-	-	-	1	-	3

List of Experiment

Sr. No.	Experiment Title	S/O	Hours
01	Study of various Computer Networking models and connectivity devices.	S	2
02	Implementation of cross-wired cable and straight through cable using crimping tool.	O	2
03	Study of IP address configuration &following connectivity test tools with all its options –ifconfig, arp, traceroute, nmap, netstat, finger.	O	2
04	Implementing Framing method: Bit Stuffing	O	2
05	Implementing Elementary data link protocol (Stop & wait protocol)	O	2
06	Implementation of Error detection Code (CRC / Hamming)	O	2
07	Implementation of sliding window protocol.	O	2
08	Implement the routing algorithm (any one).	O	2
09	Programs for connection oriented (TCP) client-server using socket programming	O	2
10	Programs for connection less (UDP) client-server using socket programming	O	2
11	Study of following DNS Tools with all its options. nslookup, dig, host,whois.	O	2
12	Study of network protocol analyzer (Wire-Shark) and understanding packet formats for UDP, TCP& Application Layer protocols.	O	2

S-study, O-operational

Instructions for practical examinations and termwork:
It should consist of 10-12 experiments based on the syllabus and should be implemented by using Socket Programming. The study experiments should consist of some practical work and observations.

Student's activities that can be conducted:
1. Group-play activities for demonstration of data-link layer protocols.
2. Industrial visit to a networking-based industry.
3. Group/Individual Presentation activity after a visit to a networking-based industry or laboratory.
4. Implementation and Configuration of the TFTP / FTP Client-Server model, in a group (2-5 students per group).
5. Seminar / Webinar / Workshop for students by an Industrial expert.

Text Books:
1. Behrouz A. Forouzen, TCP/IP protocol Suit, Tata Mag.Hill, 4thEd.
2. W. Richard Stevens (PHI), Unix Network Programming
3. Kurose James F., Ross Keith W., Computer Networking: A Top-Down Approach, Sixth Edition, By Pearson.
4. Peter L Dordal, An Introduction to Computer Networks, Release 1.9.15.

Reference Books:
1. Andrew S. Tanenbaum (PHI), Computer Networks
2. D. E. Comer, David L. Stevens (Pearson Ed.), Internetworking withTCP/IP, Vol. III, Client-Server programming and applications (2nd Edition).

Course Plan

Course Title: Environmental Studies (Mandatory Course-I)	
Course Code: 201AIMLMC209	**Semester: III**
Teaching Scheme: L-T-P: 2-0-0	**Credits: No Credits**
Evaluation Scheme: ISE+MSE-Not Applicable	**ESE Marks – 50**

Course Description:

Environmental Studies course enhance a student's knowledge in a variety of currently relevant topics related to environmental awareness and pollution. The course aims to identify environmental problems, come-up with suitable solutions and create awareness for a hygienic and eco-friendly environmental.

Course Objectives:

1 Recognize the structure and functions of ecosystems with their importance.
2 Understand the environmental and social problems with global concern.
3 Understand the importance of environmental management for its protection.
4 Acquire problem solving skills through visits to different locations, identifying the environmental problems, proposing the solution models and exhibiting to the society and government authorities.

Course Outcomes (COs):

Cos	At the end of successful completion of course, the students will be able to…
C209.1	Understand the importance of ecosystem and biodiversity in view of its conservation.
C209.2	Understand the concept of hazardous waste and to promote healthier environment.
C209.3	Explain the importance of environmental management through pollution control boards.
C209.4	Propose solutions for problems related with environmental well beings through location visits and model exhibitions.

Prerequisite:	Understanding of Environmental Education course.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C209.1	-	-	-	-	-	1	3	2	-	-	-	-	-	-	2
C209.2	-	-	-	-	-	1	2	-	-	-	-	-	-	-	2
C209.3	-	-	-	-	-	1	3	-	1	1	-	-	-	-	2
C209.4	-	-	-	-	-	2	3	1	1	1	-	-	-	-	3

Course Content	Hours
Unit 1.Ecology and Biodiversity Definition, types, importance and examples of ecology, types of community relationships: Symbiosis, predation and competition. Ecosystem: structure and functions, biotic and abiotic components, energy flows, ecological succession, food chain, food web & ecological pyramid, types of ecosystems, degradation of ecosystems and its impact. Biodiversity hotspots: Western ghats, eastern Himalayas, threats to biodiversity and conservation of biodiversity, environmental ethics.	8
Unit 2.Environment and Health Air Pollution, water pollution. E-waste, waste minimization technology, Plastic waste, Population growth of the world and reduced health content of the environment, energy crisis, biofuels, Occupational health hazards, Concept of Carbon footprint.	7
Unit 3.Environmental Management Role of Central Pollution Control Board (CPCB) and Maharashtra Pollution Control Board (MPCB) in environmental protection of India. Concept of sustainability, ISO Certification.	5
Unit 4.Field Work Visit to a local area for documentation of environmental assets River/forest/grassland/hill/mountain OR Visit to a local polluted site-Urban/Rural/Industrial/Agricultural OR Study of common plants, insects, birds OR Study of simple ecosystems- Ponds, Lakes, Rivers, Hill slopes, etc.	5

Text Books:

1 Trivedi R.K. and P.K Goel, Introduction to Air Pollution, Tech-science Publications.

2 Mhaskar A.K, Matter Hazardous, Techno-Science Publication.

Reference Books:

1 Bharucha, Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad 380013, India

2 Hawkins R.E., Encyclopaedia of Indian Natural History, Bombay Natural History Society, Bombay

3 Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I &II, Environmental Media.

4 Miller T.G. Jr., Environmental Science, Wadsworth Publications Co.

5 Sharma B.K., Environmental Chemistry, Gokel Publ. House, Meerut.

Course Plan

Course Title: Probability and Statistics	
Course Code: 201AIMLL210	**Semester: IV**
Teaching Scheme: L-T-P: 3-1-0	**Credits:4**
Evaluation Scheme: ISE+MSE Marks: 20+30	**ESE Marks:50**

Course Objectives:

1. To introduce students to understand, explain and apply the fundmental probability and statistical concepts at the core of computer science
2. To understand use of concepts of stataistics, measures of dispersion
3. To learn the fundamental theory of testing hypothesis and sample tests
4. To learn the concepts of correlation, regression and curve fitting
5. To understand use of recurrence relation

Course Outcomes COs:

At the end of this course students will be able to

C210.1	Apply the knowledge to study the data given with respect to dispersion and measure of central tendency
C210.2	Understand tests for hypothesis and its significance
C210.3	Describe the statistical data numerically by using correlation, regression and curve fittings.
C210.4	Solve basic problems in probability theory, including problems involving the binomial, poisson, and normal distributions.
C210.5	Apply the recurrence relation to solve the counting problemms and programme analysis problems

Prerequisite	Basic Probability Theory

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

COs	**POs**												**PSOs**		**BTL**
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	
C210.1	3	2	-	-	2	-	-	-	-	-	-	-	-	-	3
C210.2	3	2	-	-	-	-	-	-	-	-	-	-	-	-	3
C210.3	3	2	-	-	2	-	-	-	-	-	-	-	-	-	3
C210.4	3	2	-	-	2	-	-	-	-	-	-	-	-	-	3
C210.5	3	2	-	-	2	-	-	-	-	-	-	-	-	-	3

Contents	Hours
Unit 1 Frequency distribution and measure of central Tendency Frequency distribution, Continuous frequency distribution, Graphical representation of a Frequency distribution- Histogram, frequency polygon, Measure of central tendency- Arithmetic mean, median and mode ,Range, Quartile deviation, Mean deviation ,Standard deviation.	**06**
Unit 2 Testing of hypothesis Introduction, Statistical hypothesis (Simple and Composite),Null hypothesis, Alternative hypothesis, Critical region ,Type I and Type II errors ,Level of significance ,Test for goodness of fit of chi square distribution.	**06**
Unit 3 Correlation and Regression Introduction, Types of correlation, Karl Pearson's coefficient of correlation , Interpretation of the coefficients of corrections, Computation of coefficient of correlation for ungroup data, Lines of regression , Calculations of equations of the lines of regression.	**06**
Unit 4 Probability Distribution Functions Introduction, Elementary theory of probability, Random variables, Discrete probability distribution, Continuous probability distribution, Binomial distribution, Poisson distribution, Normal distribution.	**06**
Unit 5 Recurrence Relation Introduction, Definition of recurrence relation ,Linear recurrence relation with constant coefficients, Construction of recurrence relation, Solution of recurrence relation- Homogeneous and non-homogeneous, Solution of homogeneous and non-homogeneous recurrence relation	**06**

Unit-6 Curve Fitting Fitting of curve by method of least squares, Fitting of straight lines, Fitting of exponential curve, Fitting of second degree parabolic curve	**06**

Tutorials for Probability and Statistics

Sr. No	Title of Tutorial	Contact Hr.
1.	Measure of Central Tendency	1
2.	Testing of Hypothesis	1
3.	Computation of Correction	1
4.	Lines of Regression	1
5.	Probability Distribution- Binomial Distribution and Poisson Distribution	1
6.	Probability Distribution- Normal Distribution	1
7.	Recurrence Relation	1
8.	Curve Fitting	1
9.	Fitting of First and Second Degree Curve Using SCILAB/MATLAB	1
10.	Measure of Central Tendency Using SCILAB/MATLAB	1

Text Books:

1. Walpole, Myers, Myers, Ye, Probability and Statistics for Engineers and Scientists, Pearson Education Inc., 8th Edition, 2007, ISBN: 978-81-317-1552-9.
2. Numerical Methods in Engineering and Science, by Dr. B. S. Grewal

Reference Books

1. Douglas C Montgomery, George C Runger, Applied statistics and Probability for Engineers, Wiley Asia Student Edition, 4th Edition, 2007, ISBN: 978-81-265-2315
2. Richard I Levin, David S Rubin, Statistics for Management, Prentice Hall India, 7th Edition, 1997, ISBN: 9780134762920.
3. Purna Chandra Biswal, Probability and Statistics, PHI Learning Private Limited, Eastern Economy Edition, 2007, ISBN: 978-81-203-3140-2

Course Plan

Course Title : Operating Systems	
Course Code : 201AIMLL211	**Semester : IV**
Teaching Scheme : L-T-P : 3-0-0	**Credits : 3**
Evaluation Scheme : ISE + MSE Marks : 20 + 30	**ESE Marks : 50**

Course Description: This course provides comprehensive overview of computer operating systems. It covers the foundation components, classical internal algorithms and structures of operating systems, including process scheduling, memory management and IO management.

Course Objectives:

1. To learn the basic concepts of operating system, services and operations in the operating system.
2. To expose the students to various functions of the operating system and their usage.
3. To make the students understand process management, memory management and I/O device Management.
4. To provide knowledge to the students about the fundamental architecture of UNIX and operating system kernel.

Course Outcomes (COs):

At the end of the course the student should be able to:

C211.1	Understand the structure, functions and services of an operating system.
C211.2	Describe the methods of process management, process synchronization and deadlocks.
C211.3	Demonstrate the various memory management and I/O management techniques in effective execution of programs.
C211.4	Analyze the process scheduling, memory management and I/O management techniques.

Prerequisite:	Fundamental knowledge of computer, C programming, Data Structure

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C211.1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	2
C211.2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	1
C211.3	2	2	-	-	-	-	-	-	-	-	-	-	-	-	2
C211.4	2	3	-	-	-	-	-	-	-	-	-	-	-	-	4

Content	Hours
Unit 1. Introduction Evolution of operating systems, Types of operating systems, Different views of the operating system, The journey of a command execution, Overview of design and implementation of operating systems.	5
Unit 2. Process Management & Synchronization Process Concept, Operations on Processes, Interprocess Communication, Threads, Process Synchronization - Race Conditions, Critical Sections, Synchronization Approaches, Classic Process Synchronization Problems, Semaphores, Monitors.	6
Unit 3.Process Scheduling & Deadlock Scheduling Terminology and Concepts, Nonpreemptive Scheduling Policies, Preemptive Scheduling Policies,Process Scheduling- Case Studies, Deadlocks - Deadlocks in Resource Allocation, Handling Deadlocks, Deadlock Detection and Resolution, Deadlock Prevention, Deadlock Avoidance.	7
Unit 4. Memory Management Managing the Memory Hierarchy, Static and Dynamic Memory Allocation, Memory Allocation to a Process, Contiguous Memory Allocation, Noncontiguous Memory Allocation, Paging, Segmentation, Virtual Memory-Demand Paging, Page Replacement Policies.	6

Unit 5. File Systems and I/O Management Overview of File Processing,Files and File Operations,Fundamental File Organizations and Access Methods, Directories, Layers of the Input-Output Control System, Overview of I/O Organization, I/O Devices, Device Drivers.	7
Unit 6. Unix Operating System (Case Study) System structure, User perspective, Architecture of the UNIX operating system, Introduction to system concepts, Kernel data structures, system administration,System calls for the file system-introduction, NetworkbasedOperating Systems.	5

Text Books:

1. Milan Milenkovic, Operating systems concepts and design, McGRAW-Hill,2nd edition [Unit 1]
2. Silberschatz, Galvin, Gagne, Operating system concept, Wiley India,8th edition.[Unit 2, 6]
3. Dhananjay M Dhamdhere, Operating systems - A Concept Based approach, Mc-Graw Hill, 3rd Edition.[Unit 3 to 5]
4. Maurice J. Bach, The design of Unix Operating System,PHI.[Unit 6]

Reference Books:

1. William Stallings, Operating Systems: Internals and Design Principles,Pearson,7th edition
2. Andrew S. Tanenbaum, Modern Operating Systems, Pearson Education International, 4th edition.
3. Achyut S.Godbole ,Operating System with case studies in UNIX, Netware and Windows NT, TMGH.

Online Resources:

1. https://nptel.ac.in/courses/106/105/106105214/#
2. https://nptel.ac.in/courses/106/102/106102132/
3. https://www.cse.iitb.ac.in/~mythili/os/

Course Plan

Course Title :Computer Algorithms	
Course Code :201AIMLL212	**Semester : IV**
Teaching Scheme : L-T-P : 3-0-0	**Credit : 3**
Evaluation Scheme:ISE+MSE Marks:20+30	**ESE Marks:50**

Course Description: This course introduces basic methods for the design and analysis of efficient algorithms. Different algorithms for a given computational task are presented and their relative merits evaluated based on performance measures.It introduces the fundamental techniques for designing and analysing algorithms, including asymptotic analysis, divide-and-conquer algorithms, greedy algorithms, dynamic programming, traversal methods and even backtracking approach. It also provides introduction to NP-completeness.

Course Objectives:

Sr. No.	Course Objectives
1	To introduce algorithm design methods / techniques with analysis
2	To devise algorithm for given problem statement and compute its complexity
3	To introduce complex computational problems

Course Outcomes:

COs	Course Outcomes
	Upon successful completion of the course, student will be able to…
C212.1	Understand and demonstrate algorithm design methods with analysis
C212.2	design algorithm for given problem statement and analyse its space and time complexity by using recurrence relation
C212.3	Categorize the problem to determine polynomial and non-polynomial based on its nature.

Prerequisite:	Data Structures, Discrete Mathematics, Engineering Mathematics, Programming Concepts.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C212.1	2	2	1	-	-	-	-	-	-	-	-	-	-	-	3
C212.2	3	1	2	-	-	-	-	-	-	-	-	-	2	-	3
C212.3	-	2	-	-	-	-	-	-	-	-	-	-	-	-	4

Contents	Hours
Unit 1: Divide and Conquer: What is algorithm, Algorithm Specification, Recurrence relations, Performance Analysis, Randomized Algorithms .Divide and Conquer: The general method, Binary search, Finding the maximum and minimum, Merge sort, Quicksort, DC Selection Algorithm, analysis of Divide and Conquer algorithms.	10
Unit 2:The Greedy Method: The general method, Knapsack problem, Job sequencing with deadlines, minimum-cost spanning trees – Prim's and Kruskal's Algorithms, Optimal storage on tapes, Optimal merge Patterns, Single source shortest paths.	06
Unit 3:DynamicProgramming: The general method, Multistage graphs, All pair shortest paths,0/1 knapsack, Reliability design, Traveling Sales person problem.	06
Unit 4:Basic Traversal and Search Techniques: Techniques for Binary Trees, Game Tree; Techniques for Graphs – Breadth First Search & Traversal, Depth First Search& Traversal, AND/OR graphs; Connected components and Spanning Trees; Bi-connected components and depth first search.	06
Unit 5: Backtracking: The general method, 8-queen problem, sum of subsets, Knapsack Problem, Hamiltonian Cycle, and Graph Coloring. String Algorithms: Introduction, String Matching Algorithm, Brute Force Method, Robin -Karp String Matching algorithm, String Matching with Finite Automata	06
Unit 6: NP Hard and NP Complete Problems: Basic Concepts, Introduction to NP Hard Graph Problems.	05

Text Books:

1. Fundamentals of Computer Algorithms Ellis Horowitz, Satraj Sahani, Saguthevar Rajasekaran UniversitiesPress,Second Edition (All Units)

Reference Books:

1. Data Structures and Algorithmic Thinking with PYTHON (Data Structure and AlgorithmicPuzzles) NarasimhaKarumanchi (MTech IIT Bombay)CareerMonk Publications(Refer for String Algorithms in unit 5)
2. Fundamentals of Algorithms Gilles Brassard, PaulBratley, Pearson Education.
3. Mastering Algorithms with C Kyle Loudon SPD O'Reilly.
4. Computer Algorithms-Introduction to Design andAnalysisSaraBaase, Allen VanGelder, Pearson Education.
5. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein**,** "Introductionto Algorithms," Third Edition PHI 2010.

Online Resources:

1. https://nptel.ac.in/courses/106/104/106104019/

Course Plan

Course Title : Fundamentals of Artificial Intelligence	
Course Code : 201AIMLL213	Semester : IV
Teaching Scheme : L-T-P : 3-0-0	Credits : 3
Evaluation Scheme : ISE + MSE Marks : 20 + 30	ESE Marks : 50

Course Description:

AI is a part of computer science based on theoretical and applied principles of that field. These principles include the data structures used in knowledge representation, the algorithms needed to apply that knowledge, and the languages and programming techniques used in their implementation. AI features include the use of computers to do reasoning, pattern recognition, learning or some other form of inference.

Course Objectives:

1. To expose the students to basic concepts and principles of AI.
2. To introduce the various tools for AI problem solving.
3. To make the students aware of various concepts for representing information in AI.

Course Outcomes (COs):

At the end of the course the student should be able to:

C213.1	Identify AI problems and their features.
C213.2	Use predicate calculus and propositional logic for knowledge representation.
C213.3	Use heuristics in search based problems.
C213.4	Use semantic networks, conceptual dependencies scripts and frames for information representation.

Prerequisite:	Knowledge of basic Computer Algorithms

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C213.1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	3
C213.2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	3
C213.3	2	1	-	-	-	-	-	-	-	-	-	-	-	-	3
C213.4	3	-	-	-	-	-	-	-	-	-	-	-	-	-	3

Content	Hours
Unit 1: AI- Its Root and Scope Early history and applications, Attitude towards intelligence, knowledge and human artifices, Overview of AI application areas, AI- A summary	4
Unit 2: Representation and Search The proportional calculus, The predicate calculus, Using inference rules to produce predicate calculus expression, Graph theory, Strategies for state space search, Introduction to heuristic search, Hill climbing and dynamic programming, Best first search algorithm, Using heuristics in games	8
Unit 3: Representation and intelligence: Issues in knowledge representation, Brief history of AI representational schemes, Introduction to conceptual graphs, Type, individuals and names, Generalization & specialization	6
Unit 4: Rule based expert system: Introduction, K rules as knowledge, representation, schemes, Expert system development teams, Structure, Characteristics, Forward chaining and backward chaining inference techniques., Media Advisor: A Demonstration, Conflict resolution, Advantages and disadvantages	6
Unit 5: Uncertainty management in rule based expert system : Introduction, Basic probability theory, Bayesian reasoning, Forecast, Certainty factors theory and evidential reasoning, Comparison of Bayesian reasoning and certainty factors	6

Unit 6: TensorFlow- Basic Concept : Machine learning and deep learning concepts, TensorFlow- general overview, Installing TensorFlow, first working session, Data Flow graph, TensorFlow Programming model, How to use TensorBoard.	8

Text Books:

1. Gorge F Luger, Artificial Intelligence; structures and strategies for complex problem solving. Pearson Education, 5th Edition.[Units 1, 2, 3 &6]
2. Michael Negnevistsky, Artificial Intelligence: A guide to intelligent systems, Person Education, 2nd edition. [Units 4, 5]
3. Giancarlo Zaccone, Getting started with TensorFlow, Packt Publishing, 2016.[Unit 6].

Reference Books:

1. Dan W. Patterson, Introduction to Artificial Intelligence, Pearson Education India, 6 January 2015

Online Resources:

1. https://nptel.ac.in/courses/106/102/106102220/
2. https://onlinecourses.nptel.ac.in/noc21_ge20/preview

Course Plan

Course Title: Formal Automata and Applications	
Course Code: 201AIMLL214	**Semester: IV**
Teaching Scheme: L-T-P: 3-0-0	**Credits:3**
Evaluation Scheme: ISE + MSE Marks: 20 + 30	**ESE Marks:50**

Course Description:

The course introduces some fundamental concepts in automata theory including grammar, finite automaton, regular expression, formal language, pushdown automaton, and Turing machine. Not only do they form basic models of computation, they are also the foundation of many branches of computer science, e.g. compilers, software engineering etc. Formal systems and Automata is important because it allows scientists to understand how machines solve problems. Automata Theory is an exciting, theoretical branch of computer science. Learning how to design automatons helps to improve the logical thinking capability of the student.

Course Objectives:

1. To expose the students to the mathematical foundations of computation, the theory of formal languages and grammars.
2. To analyze and design finite automata, pushdown automata, grammar for formal languages & Turing machines along with its applications.
3. To strengthen the students' ability to carry out formal and higher studies in computer science.
4. To Learn Markov Chains and its applications

Course Outcomes (COs):

At the end of the course the student should be able to:

C214.1	Understand the concept of abstract machines and their power to recognize the languages.
C214.2	Design context free grammars for formal languages and simplify using normal forms and design parsers
C214.3	Understand the concepts of push down automata and properties of RL and CFL
C214.4	Design the computational and acceptor machines using FA, PDA and Turing machines
C214.5	Expose to Markov chains & its application

Prerequisite:	Discrete Mathematical Structure

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C214.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
C214.2	-	1	1	-	-	-	-	-	-	-	-	1	-	-	3
C214.3	2	-	-	-	-	-	-	-	-	-	-	1	-	-	3
C214.4	2	2	2	-	-	-	-	-	-	-	-	1	2	-	3
C214.5	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2

Content	Hours
Unit 1. Introduction to Regular Languages and Finite Automata **Regular Languages**: Regular Language, Recursive definition of Regular Expressions, Examples on writing Regular Expressions for Regular Languages, Closure Properties of Regular Language. Finite Automata Definition, Designing DFA, Union, Intersection &Complement of Regular Languages and DFA, Applications of FA, Introduction to Output producing FAs: Mealy and Moore machine	8
Unit 2. Non determinism and Kleene's Theorem Nondeterministic finite automata and NFA with null transition along with corresponding extended transition function, Examples on designing NA and NFA- null, Equivalence of FA's, Kleene's Theorem Part I along with its proof, Examples on constructing NFA – null using Kleene's theorem, Kleene's Theorem Part II (only introduction to statement), Minimal State Finite Automata	7
Unit 3.Grammar Formalism Definition, Types of Grammar (Chomsky Hierarchy),Application of grammar: Derivation & Reduction, Parse trees and ambiguity, Union, Concatenation and Kleene *'s of CFLs to construct Grammar, Properties of CFL: Union, Concatenation and Kleene *'s of CFLs,	6

intersections and complements of CFLs, Simplified Forms and Normal Forms i.e., Converting CFG to CNF, Introduction to GNF, BNF	
Unit 4-Push Down Automata and Parsing Definition and Examples of Pushdown Automata, Applications of PDA, Deterministic PDA, NPDA, Equivalence of CFG's & PDA's, Top-down parsing, Bottom-up parsing.	6
Unit 5– Turing Machines Definition, TM as language acceptors, Computing partial function with a TM, Variants of TM and Universal TM, Applications of Turing Machine.	5
Unit 6–Markov Chains Markov Chains: Definitions and Representations, Application: A Randomized Algorithm for 2-Satisfiability, Classification of States Example: The Gambler's Ruin	5

Term work:

- It should consist of minimum10 assignments based on topics of syllabus which are included in exercise problems from the textbooks or reference books
- Carry out any 8 assignments from assignment no. 1 to 13 listed below.
- Assignment no. 14 and 15 are compulsory.
- Assignments can be given on the basis of following guidelines:

Sr. No.	Title	O/S
1	Examples on Regular Languages and writing regular expressions	O
2	Designing DFAs and Extended Transition function of DFA	O
3	Designing NFA, NFA-null and corresponding extended transition function	O
4	Problems on equivalence of FAs and union, intersection and complements of DFAs	O
5	Designing NFA- null using Kleene's Theorem Part I	O
6	Minimal state DFA and Examples	O
7	Writing grammar for given formal language, problems on left most and right most derivation along with parse tree, ambiguous grammar	O
8	Simplified Forms and Normal Forms: Examples on converting CFG to CNF /BNF	O
9	Examples on designing DPDA for the given language.	O
10	Parser: Examples on constructing top-down parser and bottom-up parser for the given Grammar	O

11	Designing Turing Machine as language acceptors and computable TM for the given language.	O
12	Example on Randomized Algorithm for 2-Satisfiability	O
13	Case Study on Classification of states	S
14	Use of Simulation tool to design DFA, NFA and NFA^	O
15	A group of 3 students to design a DFA and write a program to implement it in C programming Language.	O

S: Study based assignment O: Operational assignment

Text Books:

1. John C. Martin, Introduction to Languages & the Theory of Computations - (Tata MGH 3rd Edition)**(Unit 1 to 5)**
2. Michael Mitzenmacher,Eli Upfal Probability and Computing Randomiozed Algorithms & Probabilistic Analysis (Cambridge)**(Unit 6)**

Reference Books:

1. Theory of Computer Science – Automata languages and computation, Mishra and Chandrashekaran, 2nd edition, PHI.
2. Michael Sipser, Introduction to theory of Computations - (Thomson Books/Cole)
3. VivekKulkarni, Theory of Computation

Online Resources:

1. https://nptel.ac.in/courses/111/103/111103016/
2. https://nptel.ac.in/courses/106/106/106106049/
3. https://automatonsimulator.com/

Evaluation Guidelines:

1. ISE-I (10 Marks)

   10 Marks will be based on activity conducted (quiz, case study, problem solving, pedagogy activity etc.) by the subject in-charge.
   - ISE- I will be conducted before MSE

2. ISE –II (10 Marks)

   10 Marks will be based on activity conducted (quiz, case study, problem solving, pedagogy activity etc.) by the subject in-charge.
   - ISE- II will be conducted after MSE

Mode of conduction of ISE-I and ISE-II must be different.

Course Plan

Course Title : R Programming Laboratory	
Course Code :201AIMLP215	**Semester : IV**
Teaching Scheme : L-T-P : 2-0-2	**Credit : 3**
Evaluation Scheme : ISE Marks : 25	**ESE(POE) Marks :25**

Course Description: -

R is a well-developed, simple and effective programming language, which includes conditional loops, user defined recursive functions, input and output facilities, graphical facilities for data analysis, effective data handling and storage facility. It is a very flexible language. It provides an extensive, coherent and integrated collection of tools for data analysis and it is actively used for statistical computing and design.

Course Objectives

1. To make student aware the features of R.
2. To provide a knowledge of various packages & functions used in R.
3. To interpret and apply the R programming from a statistical perspective.

Course Outcomes

After successful completion of the course, students will be able to-

CO's	Course Outcomes	BTL
C215.1	Use the features of R to implement data structures & data frames in their application.	3
C215.2	Apply different packages & functions to create the application.	3
C215.3	Perform data manipulation & statistical tests on dataset.	2
C215.4	Perform graphical analysis using plotting commands & functions.	4

Prerequisite	Python programming

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C215.1	2	-	2	-	-	-	-	-	-	-	-	-	-	-	3
C215.2	2	2	2	-	-	-	-	-	-	-	-	-	-	-	3
C215.3	2	2	3	-	2	-	-	-	-	-	-	-	2	-	3
C215.4	2	3	2	-	-	-	-	-	-	-	-	-	-	-	3

Contents	Hours
Unit-I: Introduction to R programming What is R? Basic Features of R, Programming features of R, Installing R and RStudio, RStudio Overview, Working in the R Console, Getting Help in R and Quitting RStudio.	2
Unit-II: R Data structures and Manipulation Creating Variables, expressions, R data types and objects, Numeric, Character and Logical Data, Vectors, Scalars, Declarations, Common Vector operations, Conditional statements and loops, Arithmetic Operators, Logical Operations. Reading datasets and exporting data from R, Manipulating and processing data in R.	4
Unit-III: R packages and functions Building R Packages, Installing and loading packages, Running and Manipulating Packages, Setting up your working directory, Downloading and importing data, working with objects, Viewing Objects within Objects, Constructing Data Objects, Functions in R, Creating functions, calling functions, Writing R scripts.	4
Unit-IV: Matrices, Arrays and Lists Creating matrices, Matrix operations, Applying Functions to Matrix Rows and Columns, Adding and deleting rows and columns, Vector/Matrix Distinction, Avoiding Dimension Reduction, Higher Dimensional arrays. Lists – Creating lists, General list operations, Accessing listcomponents and values,applying functions to lists, recursive lists.	4
Unit-V: Data Frames Creating Data Frames, Matrix-like operations in frames, Merging Data Frames, Applying functions to Data frames, Factors and Tables, factors and levels, Common functions used with factors, Working with tables, functions are objects, Environment and Scope issues, Writing Upstairs, Recursion, Replacement functions, Tools for composing function code.	4
Unit-VI: Introduction to Graphical Analysis and plots Using Plots(Box Plots, Scatter plot, Pie Charts, Bar charts, Line Chart), Plotting variables, Designing Special Plots, Histograms. Statistical functions for central tendency, variation, handling of bivariate data through graphics, Simple Liner Regression, Multiple Regression, and Interactive reporting with R markdown.	6

Text Books:

1. Jared P. Lander, “R for Everyone: Advanced Analytics and Graphics”, Addison-Wesley Data & Analytics Series.
2. Norman Matloff , “The Art of R Programming”.
3. Big Data (Black Book)- DT Editorial Services- Dreamtech Press.

Reference Books:

1. Robert Knell, "Introductory R: A Beginner's Guide to Data Visualisation, Statistical Analysis and Programming in R", Amazon Digital South Asia Services Inc, 2013.
2. Mark Gardener, " Beginning R – The Statistical Programming Language", Wiley, 2013.
3. Michael Akritas, " Probability & Statistics with R for Engineers and Scientists", 2nd Edition on, CRC Press, 2016.

Online Resources:

1. https://www.coursera.org/learn/r-programming

List of Experiments			
Expt. No.	**Name of Experiment**	**S/O**	**Hours**
1	Installation of R and RStudio.	O	2
2	Demonstration of declaring R variables, objects, expressions, vectors and assigning values &Perform program for reading data from R and writing data into R.	O	2
3	Implementation of package in R& create a program for calling functions in R.	O	2
4	Perform various matrix operations &Implementthe higher dimensional array in R.	O	2
5	Create list in R and perform various list operations to access list elements in R.	O	2
6	Create Data Frame in R and perform various operations on data frame &Demonstratethe common functions on factors and tables in R	O	2
7	Demonstration of plots in R as Box Plots, Pie Charts, Bar charts, Line Chart and histogram.	O	2
8	Study of Simple Liner Regression and Multiple Regression in R.	S	2
9	Write an R script to find subset of dataset by using subset (), aggregate () functions on iris dataset.	O	2
10	Import a data from web storage. Name the dataset and now do Logistic Regression to find out relation between variables that are affecting the admission of a student in a institute based on his or her GRE score, GPA obtained and rank of the student. Also check the model is fit or not.	O	2

11	Case study on How to calculate the correlation between two variables. How to make scatter plots. Use the scatter plot to investigate the relationship between two variables	S	2
12	Case Study on Generate and Visualize Discrete and continuous distributions using the statistical environment. Demonstration of CDF and PDF uniform and normal, binomial Poisson distributions	S	2

- **S-STUDY, O-OPERATIONAL**

Note: The instructor may choose minimum ten experiments from experiment no. 1 to 12.
ISE- In Semester Evaluation:

Continuous assessment of laboratory work is to be done based on overall performance and lab assignments performance of student

Course Plan

Course Title: Artificial Intelligence Laboratory	
Course Code : 201AIMLP216	**Semester : IV**
Teaching Scheme : L-T-P : 0-0-2	**Credits : 1**
Evaluation Scheme: ISE Marks: 25	**ESE(POE) Marks: 50**

Course Description: The Laboratory for AI consists of understanding and implementing the basic principles and concepts of AI using an appropriate technique. The experiments provide better understanding of various algorithms used in AI. Exposure to various case studies like expert system, MYSIN and AI SHELL is covered.

Course Objectives:

1. To expose the students to basic concepts and principles of AI.
2. To introduce the various algorithms of AI for problem solving.
3. To make the students aware of expert system and open source platform for implementing AI applications.

Course Outcomes (COs):

At the end of the course the student should be able to:

C216.1	Represent knowledge using propositional and predicate logic.
C216.2	Solve the problems using various searching techniques of AI.
C216.3	Demonstrate the use of heuristics technique for game playing.
C216.4	Develop simple expert system.
C216.5	Use tensor flow framework for implementing AI applications.

Prerequisite:	Data Structures

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C216.1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2
C216.2	3	1	1	-	-	-	-	-	-	-	-	-	-	-	3
C216.3	3	1	2	-	-	-	-	-	-	-	-	-	-	-	3
C216.4	3	-	1	-	-	-	-	-	-	-	-	-	-	-	3
C216.5	3	-	2	-	2	-	-	-	-	-	-		-	-	3

Sr. no	Name of Experiment	Type	Hours
1	Study experiment on propositional logic and predicate logic.	S	2
2	Implementation of Best First Search (BFS)	O	2
3	Implementation of Depth First Search (DFS),	O	2
4	Implementation of Breadth First Search (BFS).	O	2
5	Implementation of Implementation of Tic Tac Toe game using heuristics.	O	2
6	Study experiment on conceptual graphs (semantic nets, conceptual dependency, and 3rd graph).	S	2
7	Case study on Expert System.	S	2
8	Development of a simple expert system	O	2
9	Installation of Tensor flow	O	2
10	Implementation of computational graph using Tensor flow core	O	2
11	Study of Tensor board.	S	2
12	Case study on MYSIN and AI SHELL	S	2

- **S-STUDY, O-OPERATIONAL**

Note:-**The instructor may choose minimum ten experiments from experiment no. 1 to 12.**

Text Books:

1. Russell &Norvig ,Artificial Intelligence: A Modern Approach,.. 1995, Prentice Hall.

2. Elain Rich and Kevin Knight , Artificial Intelligence,1991 , TMH.
3. StaurtRussel and peter norvig, Artificial Intelligence-A modern approach, 1998, PHI.
4. Patrick Henry Winston, Artificial intelligence, 1992, Addition Wesley 3 Ed.

Reference Books:

1. Gorge F Luger, Artificial Intelligence; structures and strategies for complex problem solving,Pearson Education 5th Edition.

Online Resources:

1. https://nptel.ac.in/courses/106/106/106106126/

Course Plan

Course Title : Soft Skills Laboratory	
Course Code : 201AIMLP217	**Semester : IV**
Teaching Scheme : L-T-P : 0-0-2	**Credits : 1**
Evaluation Scheme : ISE Marks: 25	**ESE(OE)Marks : 25**

Course Description:

Soft skills are character traits and interpersonal skills that characterize a person's relationships with other people. This course includes Communication skills, Writing skills, Techniques for self-development, Teamwork and group discussions, Time and stress management, Professional skills for overall development of an Engineer.

Course Objectives:

1. To make the engineering students aware of the importance, the role and the content of soft skills.
2. To develop and nurture soft skills of the students through individual and group activities.
3. To expose students to right attitudinal and behavioral aspects and to build the same through activities.
4. To encourage overall development of students by focusing on soft skills.

Course Outcomes (COs):

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

C217.1	Effectively use skills to communicate clearly and improve listening and writing skills.
C217.2	Make use of techniques for self-awareness and self-development.
C217.3	Understand the importance of teamwork and group discussion skills.
C217.4	Apply time management and stress management skills.
C217.5	Apply professional skills and ethics effectively being an Engineer.

Prerequisite:	Basic communication and writing skills in English.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C217.1	-	-	-	-	-	-	-	-	-	3	-	-	-	-	3
C217.2	-	-	-	-	-	-	-	-	2	-	-	-	-	-	3
C217.3	-	-	-	-	-	-	-	-	2	2	-	-	-	-	2
C217.4	-	-	-	-	-	-	-	-	2	-	-	-	-	-	3
C217.5	-	-	-	-	-	-	-	2	-	-	-	-	-	-	3

Contents	Hours
Unit 1: Getting Started with Soft Skills Introduction to Soft Skills, Communication Basics, Official Communication, Online Meetings, Comprehension, Reading Research Papers.	4
Unit 2: Behavioral Skills and Self Development Confidence Improvement, Positive Attitude, Positive Thinking, Personal Accountability, Diversity Awareness, Empathy, Emotional Intelligence, Emotional Quotient, Self-Management: Self-Evaluation, Self-Discipline, Self-Awareness.	4
Unit 3: Leadership and Team Building Culture and Leadership: Salient Features of Corporate Culture, Leadership Styles, Leadership Trends. Team Building: Types of Teams, Team Development Stages, Attributes of a Successful Team, Barriers involved, Role of Team leader.	4
Unit 4: Developing Writing skills Writing Proposals, Project Synopsis, Report Writing, Technical Paper Writing, Writing for Employment: Job Search, Cover Letter, Functional and Chronological Resumes, Professional Correspondence.	4

Unit 5: Stress and Time Management Stress in Today‘s Time, Positive Stress, Negative Stress, Types of Stressors,Identifythe Stress Source, Reasons and Effects, Identifying Stress, The four A's of Stress Management, Approaches: Action-oriented, Emotion-oriented and Acceptance-oriented. Time Management, Time Management Techniques.	4
Unit 6: Professionalism Goal Setting, Planning and Managing Carrier, Developing Work Ethics, Presenting yourself Professionally: Dressing Etiquettes, Corporate Grooming and Dressing, Etiquette and Mannerism: All types of Etiquettes. Technology Etiquette: Email and Telephone Etiquette, Interview Etiquette. Job Interview: Types of Interviews as Telephonic, Face to Face and Online Interview.	4

Text Books:

1. Krishna Mohan and MeeraBanerji- Developing Communication Skills by MacMillan India Ltd., Delhi
2. Gajendra Singh Chauhan, Sangeeta Sharma- Soft Skills – An Integrated Approach to Maximize Personality, WILEY INDIA, ISBN:13:9788126556397.
3. The Ace of Soft Skills: Attitude, Communication and Etiquette for Success, Pearson Education, Edition 1, 2013.
4. PriyadarshiPatnaik- Group Discussions and Interview Skills, Cambridge University Press.

Reference Books:

1. Essentials of Effective Communication, Ludlow and Panthon; Prentice Hall of India.
2. Francis Sounderaj- Basics of Communication In English, MacMillan India Ltd.
3. Simon Sweeney—English for Business Communication, Cambridge University Press, ISBN13:978-0521754507.
4. Barun K. Mitra- Personality Development & Soft Skills, Oxford Publishers, Third Impression, 2017.
5. ShaliniVerma- Development of Life Skills and Professional Practice, First Edition; Sultan Chand (G/L) & Company, 2014.
6. Remesh S, Vishnu R. G.- Life Skills for Engineers, Ridhima Publications, First Edition, 2016.

List of Sessions			
Exp.no.	**Name of Session**	**S/O**	**Hours**
1	Role Play and Drama Play	O	2
2	Attitude Activity	O	2
3	Emotional Intelligence and Emotional Quotient Test Activity	O	2
4	Leadership and Team Building Activity	O	2
5	Group Discussion Activity	O	2
6	Debate Activity	O	2
7	Presentation Skills	O	2
8	Functional and Chronological Resume writing	O	2
9	Professional Correspondence	O	2
10	Stress Management Activity	O	2
11	Time Management Activity	O	2
12	Professional Etiquettes	S	2
13	Interview Activity	O	2

- **S-STUDY, O-OPERATIONAL**
- **Note: The instructor may choose minimum 10 Sessions from Session No. 1 to 13.**

Term work:

1. Various activities to be taken based on assignments like self introduction, role play, group discussions, presentations and team activity etc.
2. Multiple set of activity based assignments can be prepared to allow multiple skills exposure for team building, value sharing, leadership and role play.
3. Faculty may arrange one or more sessions from following: yoga and meditation, stress management, relaxation exercisesand fitness exercises. Time management and personal planning sessions.
4. Continuous assessment of laboratory work is to be done based on overall performance and lab assignment performance of the student.

Course Plan

Course Title : Economics and Management for IT (Mandatory Course-II)	
Course Code : 201AIMLMC218	Semester : IV
Teaching Scheme : L-T-P : 2-0-0	Credits : No Credits
Evaluation Scheme :ISE+MSE Marks: Not Applicable	ESE Marks : 50

Course Description: This course provides a comprehensive study of basic economics terminologies, principles and the role of ICT (Information & Communication Technologies) in modern business management. This course includes economics analysis, cost estimation, project management and value analysis including modern day tools viz. online marketplace and various search for online marketing and management.

Course Objectives:

1. To get the knowledge about fundamental principles of economics.
2. To understand basic principles of cost estimation, project management and value analysis.
3. To get introduced with online marketplace for marketing and business management.
4. To understand the optimization of a Web site and SEO optimization for business communications.

Course Outcomes (COs):

At the end of the course the students should be able to:

C218.1	Identify the importance of the economics for business planning.
C218.2	Understand and apply cash flow between actors and stakeholders including depreciation of asset.
C218.3	Identify digital channels, business tools used for business communication.

Prerequisite:	Nil

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C218.1	-	-	-	-	-	-	-	-	-	-	1	1	-	-	2
C218.2	-	-	-	-	-	-	-	-	-	-	1	1	-	-	1
C218.3	-	-	-	-	2	-	-	-	1	2	-	-	-	-	4

Content	Hours
Unit 1. Introduction, Elementary Economic Analysis **Introduction:**Economics: Flow in an Economy, Law of Supply and Demand, Concept of Engineering Economics: Types of Efficiency, Definition and Scope of Engineering Economics, Elements of Costs **Frameworks and architectures:** Actors and stakeholders, Fundamental sales process, Technological elements.	5
Unit 2. Present and future worth method **Present worth method:**Revenue-dominated Cash Flow Diagram, Cost-dominated Cash Flow Diagram, Examples.**Future worth method:** Revenue-dominated Cash Flow Diagram, Cost-dominated Cash Flow Diagram, Examples.	4
Unit 3.Project Management and value analysis **Introduction:** Phases of Project Management, Guidelines for Network Construction, Critical Path Method (CPM), Gantt Chart/Time Chart, PERT. (Project Evaluation and Review Technique) **Introduction:** When to Apply Value Analysis: Value Analysis vs. Value Engineering, Function, Aims, Value Engineering Procedure, Advantages and Application Areas. **Case study:** ERP for project management	5
Unit 4. Online marketplace analysis & macro environment **Introduction:** situation analysis for digital marketing, the digital marketing environment, understanding customer journeys, online consumer behaviour and implications for marketing, business models for e-commerce. **Online macro environment:** Technological forces, economic forces, political forces, Legal forces, social forces and cultural forces.	4
Unit 5: Business communication strategy and relationship marketing **Business communication strategy development**: how to structure digital marketing strategy, strategy implementation. **Relationship marketing using digital platforms**: Introduction, the challenge of customer engagement, customer lifecycle management.	3

Unit 6. Business Communications **Digital media channels:** Introduction, search engine marketing, online public relations, e-mail marketing and mobile text messaging, social media and viral marketing, offline promotion techniques. **Case study:** An industry 4.0 Case Studies.	3

Textbooks:

1. R. Paneerselvam, Engineering Economics, PHI publication, 13th Edition (Unit 1 to 3).
2. Dave Chaffey, Fiona Ellis-Chadwik, Digital Marketing: Strategy, Implementation and Practice,Pearson Education, 6thEdition(Unit 4 to 6).

Reference Books:

1. Mark Taylor, Andrew Ashwin, N. Mankiw, Business Economicsby**.** New Delhi: Cengage Learning.
2. The Beginner's Guide to Digital Marketing (2015). Digital Marketer.
3. Pulizzi,J.(2014) Epic Content Marketing, Mcgraw Hill Education.

Online Resources:

1. https://nptel.ac.in/courses/110/105/110105067/