GEETHANJALI INSTITUTE OF SCIENCE & TECHNOLOGY
Unit of USHODAYA EDUCATIONAL SOCIETY
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Semester-5 (Theory-5, Lab-2, SC-1, MC-1)							
Sl. No.	**Category**	**Course Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	**C**
1	PCC	22A3303T	Automata Theory and Compiler Design	3	0	0	3
2	PCC	22A05M09	Software Engineering	3	0	0	3
3	PCC	22A0528T	Machine Learning	3	0	0	3
4	PEC	22A0522Ta 22A3204T 22A0520T 22A3304T	Professional Elective-I: 1. Object Oriented Analysis and Design 2. Data Warehousing and Mining 3. Computer Networks 4. Distributed Computing	3	0	0	3
5	OEC	22A0430T 22A0258T 22A0149T 22A0323Ta	Open Elective-I: 1. Principles of Communication Systems 2. Applications of Power Electronics to Power Systems 3. Building Materials 4. Automobile Engineering	3	0	0	3
6	PCC(Lab)	22A0510P	Software Engineering Lab	0	0	3	1.5
7	PCC(Lab)	22A0532P	Machine Learning Lab	0	0	3	1.5
8	SC	22A3305P	**Skill Advanced Course:** Data Wrangling with Python	1	0	2	2
9	MC	22A0526	**Mandatory Course:** Design Thinking and Innovation	2	0	0	0
Summer Internship 2 Months (Mandatory) after second year (to be evaluated during V semester)				0	0	0	1.5
				Total credits			**21.5**
Honors / Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)				**4**	**0**	**0**	**4**

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AUTOMATA AND COMPILER DESIGN					
Course Code	**L: T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A3303T	**3: 0:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**PCC**

Course Objectives:

This course will enable students to:

- Understand formal definitions of machine models
- Illustrate finite state machines to solve problems in computing
- Understand of formal grammars
- Learn different phases of compiler.
- Learn various parsing techniques.

Course Outcomes (CO):

On completion of this course, student will be able to:

- Understand the fundamental concepts of Formal Languages and Automata(L2)
- Apply the knowledge of Automata Theory, Grammars & Regular Expressions for solving various problems(L3)
- Design of Context Free Grammar for formal language(L3)
- Discuss the major phases of compilers and use the knowledge of the Lex tool(L2)
- Develop the parsers and experiment with the knowledge of different parsers design(L3)
- Summarize various optimization techniques and examine the design issues of code generator(L4)

Syllabus		**Total Hours:48**
MODULE-I	**Finite Automata**	**10Hrs**

Why Study Automata Theory? The Central Concepts of Automata Theory, Automation, Finite Automation, Transition Systems, Acceptance of a String by a Finite Automaton, DFA, Design of DFAs, NFA, Design of NFA, Equivalence of DFA and NFA, Conversion of NFA into DFA, Finite Automata with ϵ-Transition, Minimization of Finite Automata, Mealy and Moore Machines, Applications and Limitations of Finite Automata.

MODULE -II	**Regular Expressions**	**9Hrs**

Regular Expressions, Equivalence of two Regular Expressions, Finite Automata and Regular Expressions, Inter Conversion, Equivalence between Finite Automata and Regular Expressions, Pumping Lemma, Closers Properties, Applications of Regular Expressions, Grammars, Classification of Grammars-Chomsky Hierarchy, Finite Automata and Regular Grammars, Regular Expressions and Regular Grammars.

MODULE -III	Context Free Grammars	10Hrs
Context Free Grammar, Leftmost and Rightmost Derivations, Parse Trees, Ambiguous Grammars, Simplification of Context Free Grammars-Elimination of Useless Symbols, E-Productions and Unit Productions, Normal Forms for Context Free Grammars-Chomsky Normal Form and Greibach Normal Form, Pumping Lemma, Closure Properties, Applications of Context Free Grammars.		
MODULE -IV	**Introduction to Compiler**	**9Hrs**
Introduction to Compiler: Overview of Compilers, Phases of a Compiler. Lexical Analysis: The Role of Lexical Analyzer, Input Buffering, Specification of Tokens, Recognitionof Tokens, The lexical analyzer generator Lex, Design of a Lexical Analyzer generator		
MODULE -V	**Syntax Analysis**	**10Hrs**
Syntax Analysis: The role of the Parser, First and Follow, Predictive Parsing, LR Parsers-SLR, Canonical LR, LALR, Parser Generator (YACC). Syntax-Directed Definition, S-Attributed SDD, L-Attributed SDD, Translation Schemes, three address code, Principle Sources of Code Optimizations, Issues Code generation		

Text Books:

1. J.E. Hopcroft, R.Motwani and J.D.Ullman "Introduction to Automata Theory, Languages and Computation" , 3rd Edition, Pearson, 2008.
2. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman.," Compiler Principles, Techniques and Tools", Second Edition, Pearson,2014.

Reference Books:

1. K.L.P. Mishra and Chandrasekaran," Theory of Computer Science-Automata, Languages and Computation", 3rd Edition, PHI, 2007.
2. Shyamalendu Kandar, "Introduction to Automata Theory, Formal Languages and Computation", Pearson, 2013.
3. Parag H. Dave, Himanshu B. Dave, "Compilers Principles and Practice", Pearson
4. John R. Levine, Tony Mason, Doug Brown, LEX &YACC –O'reilly .

Web References:

https://onlinecourses.nptel.ac.in/noc21_cs07/preview
https://onlinecourses.nptel.ac.in/noc21_cs19/preview

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SOFTWARE ENGINEERING
(Common to CSE, AI&ML, DS, CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A05M09	3:0:0:0	3	CIE: 30 SEE:70	3 Hours	PCC

Course Objectives:

This course will enable students to:

- Learn the basic concepts of software engineering and life cycle models.
- Understand the requirements engineering and agile models.
- Interpret the basic concepts of software design
- Understand the basic concepts of black box and white box software testing and enable to design test cases for unit, integration, and system testing
- Understand the basic concepts in risk management and reengineering.

Course Outcomes (CO):

On completion of this course, student will be able to

- Use software life cycle activities for process models (L3).
- Use software requirements specifications for given problems (L3).
- Apply design concepts, component Level and user interface design for a given problem(L3)
- Apply various test cases for a given problem (L3).
- Apply quality management concepts at the application level. (L3)
- Determine risk management plans and implementation(l3)

Syllabus		Total Hours:48
Module-I	**Software, Software Engineering and Software Process**	**10 Hrs**

Basic concepts: abstraction versus decomposition, evolution of software engineering techniques, Software development life cycle (SDLC) models: Iterative waterfall model, Prototype model, Evolutionary model, Spiral model, RAD model, Agile models, software project management: project planning, project estimation, COCOMO, project scheduling, Organization and team structure, risk management.

Module-II	Requirements Engineering and Agile Models	9 Hrs

The Nature of software, The unique nature of web apps, The software myths

Requirements Engineering: Functional and non-functional requirements, the software requirements document, Requirements specification, Requirements engineering processes, Requirements elicitation and analysis, Requirements validation, Requirements management

Agile development model: What is agility, what is an agile process, XP, Agile process models, CMMI

Module-III	Design Concepts, Component Level and User Interface Design	9 Hrs
Design Concepts: Good Software Design, Cohesion and coupling, The design Process, Design concepts, design models **Component Level Design**: Introduction to components, designing class-based components **User Interface Design**: Golden rules, User Interface analysis and design		
Module-IV	**Software Testing Strategies, Project Metrics and Quality Management**	**10 Hrs**
Software Testing Strategies: coding standards and guidelines, code review, testing, types of testing. **Process and project metrics**: software measurement, A framework for product metrics. **Quality Management:** Quality, Software quality**,** metrics for software quality, software quality assurance.		
Module-V	**Risk Management and Reengineering**	**10 Hrs**
Risk Management: Risk identification, Risk projection, risk refinement, RMMM **Maintenance and reengineering:** Software maintenance, reengineering, reverse engineering and forward engineering **Case Study:** Implementation of safe home system using software engineering principles.		
Text Books: 1. Pressman R, "Software Engineering- Practioner Approach", McGraw Hill. 2. Somerville, "Software Engineering", Pearson 2.		
Reference Books: 1. Rajib Mall, "Fundamentals of Software Engineering", 5th Edition, PHI, 2018. 2. Richard Fairley, "Software Engineering Concepts", Tata McGraw Hill. 3. Jalote Pankaj, "An integrated approach to Software Engineering", Narosa.		
Web Resources: https://nptel.ac.in/courses/106/105/106105182/ http://peterindia.net/SoftwareDevelopment.html		

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MACHINE LEARNING					
Course Code	**L: T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0528T	**3: 0:0:0**	**3**	**CIE:30 SEE:70**	**3Hours**	**PCC**

Course Objectives:

This course will enable students to:

- Understand basic concepts of Machine Learning
- Study different Machine learning algorithms
- Illustrate evaluation of learning algorithms

Course Outcomes (CO):

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

- Understand the basic concepts of Machine Learning(L2)
- Understand the concept of Building, Evaluating and Improving a Model(L2)
- Apply different Classification algorithms to real-world problems(L3)
- Apply regression techniques in real-time scenarios(L3)
- Implement Clustering techniques in real-world problems(L3)

Syllabus		**Total Hours:48**
Module-I	**Introduction – Human Learning & Machine Learning**	**9Hrs**

Human Learning, Types of Human Learning, Machine Learning, Types of Machine Learning, Applications of Machine Learning, Issues in Machine Learning.
Basic types of Data in Machine Learning, Data Preprocessing: Data Cleaning, Data transformation and Data Reduction

Module-II	**Modeling and Evaluation**	**10Hrs**

Introduction, selecting a Model, training a Model, Model Representation and Interpretability, Evaluating Performance of a Model, Improving Performance of a Model

Module-III	**Supervised Learning: Classification**	**9Hrs**

Classification – Methods of Classification: Classification model, Classification Learning Steps, Classification by Decision tree Induction, Classification by Back propagation, K-Nearest Neighbor Classification, Random Forest Algorithm, Naïve Baye's Classification

Module-IV	**Supervised Learning: Regression**	**10Hrs**

Regression – Assumptions in Regression Analysis, Types of Regression: Simple Linear Regression, Multiple Linear Regression, Polynomial Regression, Logistic Regression, Curve Fitting- Method of Least Squares.

Module-V	Unsupervised Learning: Clustering	10Hrs
Clustering- Different types of clustering techniques, Partitioning Methods: K-Means Algorithm, K-Medoids algorithm, Hierarchical Clustering Methods, Density based Clustering Methods- DBSCAN, DENCLUE, OPTICS		

Text Books:

1. SaikatDutt, Subramanian Chandramouli, Amit Kumar Das, "Machine Learning", Pearson, 2019.

Reference Books:

1. Ethern Alpaydin, "Introduction to Machine Learning", MIT Press, 2004.
2. Stephen Marsland, "Machine Learning -An Algorithmic Perspective", Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series,2014.
3. Andreas C. Müller and Sarah Guido "Introduction to Machine Learning with Python: A Guide for Data Scientists", Oreilly.

Web References:

1. https://www.deeplearning.ai/machine-learning
2. https://www.cse.huji.ac.il/~shais/UnderstandingMachineLearning/index.html

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OBJECT ORIENTED ANALYSIS AND DESIGN
(Common **to CSE, AI&ML, CS, DS**)

Course Code	L: T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0522Ta	3: 0:0:0	3	CIE:30 SEE:70	3 Hours	PEC

Course Objectives:

This course will enable students to:

- Understand the concepts of Object-Oriented System
- Understand Unified approach & Object-Oriented System development methodologies.
- Demonstrate UML diagrams
- Model user interface and map object-oriented system to relational system

.

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand the concepts of object model(L2)
- Identify the classes and vocabulary of the problem domain(L2)
- Illustrate the importance of modeling and software development life cycle(L2)
- Draw the class and object diagrams for various applications(L3)
- Apply the basics of behavioral modeling to behavioral diagrams(L3)
- Model the various components and deployment diagram for the applications(L3)

Syllabus		Total Hours:48
Module-I	**Introduction to Object Model**	**9Hrs**

Introduction to Object Model: Introduction to object-oriented analysis and Design, Iterative development and the Unified Process (UP), UP phases: Inception, Elaboration, Construction and Transition, Object-oriented metrics, Evaluation of Object Model, Foundation of Object Model, Elements of object Model, Applying object Model.

Module-II	Classes and Objects	10Hrs

Classes and Objects: The Nature of an Object, Relationships among Objects, The Nature of a Class, Relationships among Classes, The Interplay of Classes and Objects, The Importance of Proper Classification, Identifying Classes and Objects, Key Abstractions and Mechanisms

Module-III	Introduction to UML	9Hrs

Introduction to UML: The importance of modeling, Principles of modeling, Object oriented modeling, why model, Conceptual model of UML, Architecture, Software Development Life Cycle.

Module-IV	Structural Modelling	10Hrs

Basic Structural Modelling: Classes, Relationships, Common Mechanisms, and diagrams, class diagrams.

Advanced Structural Modelling: Advanced classes, advanced relationships, Interfaces, Types and Roles, Packages, Object Diagrams

Module-V	Behavioral Modelling	10Hrs

Basic Behavioral Modelling: Interactions, Interaction diagrams, use cases, Use case diagrams, Activity Diagrams, Sequence Diagrams, Collaboration and Deployment diagrams.
Advanced Behavioral Modeling: Events and signals, state machines, time and space, state chart diagrams

Text Books:

1. Grady BOOCH, Robert A. Maksimchuk, Michael W. ENGLE, Bobbi J. Young, Jim Conallen, Kellia Houston, "Object- Oriented Analysis and Design with Applications", Pearson, 3rd edition, 2013.
2. Grady Booch, James Rumbaugh, Ivar Jacobson, "The Unified Modeling Language User Guide", Pearson, 12th Impression, 2012

Reference Books:

1. Mahesh P. Matha, "Object-Oriented Analysis and Design using UML", PHI
2. Brett D. McLaughlin, Gary Pollice, Dave West, "Head First Object-Oriented Analysis and Design", O'Reilly
3. John W. Satzinger, Robert B. Jackson, Stephen D. Burd, "Object-Oriented Analysis and Design with the Unified process", Cengage Learning

Web References:

1. https://www.youtube.com/watch?v=VnVHgj6OPrQ&list=PLAXUYU7PbJhhH0iWvtyD_J2L8mv15pchq
2. https://onlinecourses.nptel.ac.in/noc19_cs48/preview

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DATAWARE HOUSING & MINING

Course Code	L: T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A3204T	3:0:0:0	3	CIE:30 SEE:70	3 Hours	PEC

Course Objectives:

This course will enable students to:

- Know the basic concepts and principles of Data Warehouse.
- Study the concepts of Data Mining and Major Issues in Data Mining.
- Learn Pre-processing techniques and Data Transformation methods.
- Study the performance of Frequent Item sets and Classification.
- Understand and compare different types of Cluster Analysis.

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand the basic concepts of data warehouse and data mining(L2)
- Determine the Data Warehouse Design and Data Warehouse Schemas(L2)
- Use the Data Mining Technologies and Major Issues in Data Mining(L3)
- Apply Pre-processing techniques for Data cleaning(L3)
- Apply the Frequent Patterns and Classification Methods for item sets(L3)
- Determine the performance of the different Cluster algorithms(L3)

Syllabus		Total Hours:48
Module-I	**Data Warehousing and Online Analytical Processing**	**10 Hrs**
Data Warehouse: Basic Concepts, Data Warehouse Modelling: Data Cube and OLAP, Data Warehouse Design and Usage, Data Warehouse Schemas for Decision Support, Data Warehouse Implementation.		
Module-II	**Introduction to Data Mining**	**10Hrs**
Why Data Mining, What Kinds of Data Can Be Mined, What Kinds of Patterns Can Be Mined, Which Technologies Are Used, Major Issues in Data Mining.		
Module-III	**Data Preprocessing**	**9 Hrs**
Data Preprocessing: An Overview, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization.		
Module-IV	**Mining Frequent Patterns, Association rule mining and Classification**	**10Hrs**
Basic Concepts, Frequent Itemset Mining Methods, Classification: Basic Concepts, Decision Tree Induction, Bayes Classification Methods, Rule-Based Classification, Support vector machine.		
Module-V	**Cluster Analysis**	**9 Hrs**

Cluster Analysis: Partitioning Methods, Hierarchical Methods, Density-Based Methods, outlier analysis and detection methods.

Text Books:

1. Jiawei Han, Micheline Kamber, Jian Pei. "Data Mining: concepts and techniques", 3rd edition.
2. Pang-Ning Tan, Michael Steinbach and Vipin Kumar "Introduction to Data Mining", Pearson Education.

Reference Books:

1. Arun K Pujari, "Data Mining Techniques", Second Edition, Universities Press.
2. Sam Aanhory & Dennis Murray "Data Warehousing in the Real World", Pearson Edn Asia.
3. K. P. Soman, S. Diwakar, V. Ajay "Insight into Data Mining" , PHI,2008.

Web References:

https://www.digimat.in/nptel/courses/video/106105174/L01.html

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COMPUTER NETWORKS
(Common **to CSE, AI&ML, CS, DS**)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0520T	3: 0:0:0	3	CIE:30 SEE:70	3 Hours	PEC

Course Objectives:

This course will enable students to:

- Determine the basic concepts of Computer Networks.
- Determine the layered approach for design of computer networks
- Distinguish OSI and TCP/IP reference models
- Predict the network path used in Internet environment
- Use the format of headers of IP, TCP and UDP
- Illustrate the concepts of application layer, network security fundamentals.

Course Outcomes (CO):

On completion of this course, student will be able to:

- Use the software and hardware components of a computer network (L3)
- Apply the reference model of a computer network(L3)
- Solve the error correction and detection in existing protocols(L3)
- Predict path for routing, and congestion control algorithms(L3)
- Determine the functionality of TCP and UDP(L3)
- Use the appropriate application layer applications(L3)

Syllabus		Total Hours:48
Module-I	**The Internet and The Reference Models**	**10Hrs**

Introduction: Computer Network, Network Topologies, types of networks, Reference models- The OSI Reference Model the TCP/IP Reference Model - A Comparison of the OSI and TCP/IP Reference Models.

Physical Layer –Introduction to physical layer, Guided Media- Twisted-pair cable, Coaxial cable, Fiber optic cable, Unguided media: Wireless-Radio waves, microwaves, infrared.

Module-II	The Data Link Layer	9Hrs

The Data Link Layer: Data Link Layer Design Issues, Error Detection and Correction, Elementary Data Link Protocols, Sliding Window Protocols

Module-III	The Network Layer	10Hrs

The Network Layer: Network Layer design issues, Routing algorithms, Congestion control and Internetworking, Network layer in internet.

Module-IV	The Transport Layer	9Hrs

Transport Layer: Transport layer services, Service primitives, Elements of transport protocols**,** The Internet Transport Protocols: TCP/IP, UDP.

Module-V	**The Application Layer and Network Security**	**10Hrs**

The Application Layer: DNS, SMTP, FTP, Email and security, network security.

Text Books:

1. Andrew S.Tanenbaum, David j.Wetherall, "Computer Networks", 5th Edition, Pearson.
   James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach", 6th edition, Pearson, 2019.

Reference Books:

1. Forouzan, "Data communications and Networking", 5th Edition, McGraw Hill Publication.
2. Youlu Zheng, Shakil Akthar, "Networks for Computer Scientists and Engineers", Oxford Publishers, 2016.

Web References:

1. https://nptel.ac.in/courses/106105183/25
2. http://www.nptelvideos.in/2012/11/computer-networks.html
3. https://nptel.ac.in/courses/106105183/3

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DISTRIBUTED COMPUTING

(Common to CSE, AI&ML, DS, CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A3304T	3:0:0:0	3	CIE: 30 SEE:70	3 Hours	PEC

Course Objectives:

This course will enable students to:

- Introduce the computation models of distributed systems
- Illustrate the issues of synchronization and collection of information in distributed systems
- Describe distributed mutual exclusion and distributed deadlock techniques
- Elucidate agreement protocols and fault tolerance mechanisms in distributed systems
- Explain the cloud computing models and the underlying concepts

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand the foundations of distributed systems. (L2)
- Solve synchronization and state consistency problems. (L3)
- Use resource sharing techniques in distributed systems. (L3)
- Apply working model of consensus and reliability of distributed systems. (L3)
- Understand the fundamentals of cloud computing(L2)
- Illustrate the Cloud services and Platforms. (L2)

Syllabus		Total Hours:48
Module-I	**Introduction**	**10Hrs**

Introduction: Definition, Relation to computer system components, Motivation, Message-passing systems versus shared memory systems, Primitives for distributed communication, Synchronous versus asynchronous executions, Design issues and challenges.

A model of distributed computations: A distributed program, A model of distributed executions, Models of communication networks, Global state of a distributed system

Module-II	Logical Time and Global State	9 Hrs

Physical clock synchronization: NTP, A framework for a system of logical clocks, Scalar time, Vector time

Message ordering and group communication: Message ordering paradigms, Asynchronous execution with synchronous communication, Synchronous program order on an asynchronous system, Group communication, Causal order (CO), Total order

Global state and snapshot recording algorithms: Introduction, System model and definitions, Snapshot algorithms for FIFO channels

Module-III	Distributed Mutex and Deadlock	10 Hrs
Distributed mutual exclusion algorithms: Introduction, Preliminaries, Lamport's algorithm, Ricart–Agrawala algorithm, Token-based algorithms, Suzuki–Kasami's broadcast algorithm. **Deadlock detection in distributed systems:** Introduction, System model, Preliminaries, Models of deadlocks, Chandy–Misra–Haas algorithm for the AND model and OR model.		
Module-IV	**Consensus and Recovery**	**10 Hrs**
Consensus and agreement algorithms: Problem definition, Overview of results, Agreement in a failure-free system (synchronous or asynchronous), Agreement in (message-passing) synchronous systems with failures **Check pointing and Rollback recovery:** Introduction, Background and definitions, Issues in failure recovery, Checkpoint-based recovery, coordinated check pointing algorithm, Algorithm for asynchronous check pointing and recovery		
Module-V	**Cloud Computing**	**9 Hrs**
Definition of Cloud Computing: Characteristics of Cloud, Cloud Deployment Models, Cloud Service Models, Driving Factors and Challenges of Cloud, Virtualization, Load Balancing, Scalability and Elasticity, Replication, Monitoring **Cloud Services and Platforms**: Compute Services, Storage Services, Application Services		

Text Books:

1. Kshemkalyani Ajay D, Mukesh Singhal, "Distributed Computing: Principles, Algorithms and Systems", Cambridge Press, 2011.
2. Mukesh Singhal, Niranjan G Shivaratri, "Advanced Concepts in Operating systems", McGraw Hill Publishers, 1994.

Reference Books:

1. George Coulouris, Jean Dollimore, Time Kindberg, "Distributed Systems Concepts and Design", Fifth Edition, Pearson Education,2012.
2. Pradeep L Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India,2007.
3. Tanenbaum A S, Van Steen M, "Distributed Systems: Principles and Paradigms", Pearson Education,2007.
4. Liu M L, "Distributed Computing: Principles and Applications", Pearson Education, 2004.
5. Nancy A Lynch, "Distributed Algorithms", Morgan Kaufman Publishers, 2003.
6. Arshdeep Bagga, Vijay Madisetti, "Cloud Computing: A Hands-On Approach", Universities Press, 2014.

Web References

https://www.geeksforgeeks.org/distributed-systems-tutorial/
https://www.baeldung.com/cs/distributed-systems-guide

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PRINCIPLES OF COMMUNICATION SYSTEMS
(Common to EEE, CSE, AI&ML, IT, CS, DS)

Course Code	L:T:P:S	Credits	Exam. Marks	Exam Duration	Course Type
22A0430T	3:0:0:0	3	CIE:30SEE:70	3 Hours	OEC

Course Objectives:

This course will enable students to:

- Understand the concept of various modulation schemes and multiplexing.
- Apply the concept of various modulation schemes to solve engineering problems.
- Analyses various modulation schemes.
- Evaluate various modulation scheme in real time applications.

Course Outcomes:

After the completion of the course students will be able to:

- Understand the concept of various modulation schemes(L2)
- Understand the concept of Different multiplexing techniques(L2)
- Apply the concept of various modulation schemes to solve engineering problems(L3)
- Analyze various modulation schemes(L4)
- Apply various modulation schemes in real time applications(L3)
- Understand the concept of various Communication systems(L2)

	Syllabus	Total:48 Hrs
Module-I	**Amplitude Modulation**	**10 Hrs**

Amplitude Modulation: Introduction to Noise and Fourier Transform. An overview of Electronic Communication Systems. Need for Frequency Translation
Amplitude Modulation: DSB-FC, DSB-SC, SSB-SC and VSB, Radio Transmitter and Receiver.

Module-II	**Frequency Modulation**	**9 Hrs**

Frequency Modulation: Introduction to Angle Modulation, Tone modulated FM Signal, Arbitrary Modulated FM Signal, FM Modulation and Demodulation. Stereophonic FM Broadcasting.

Module-III	**Pulse Modulation**	**9 Hrs**

Pulse Modulation: Sampling Theorem- Low pass and Band pass Signals. Pulse Amplitude Modulation and Concept of Time Division Multiplexing and Frequency Division Multiplexing. Pulse Width Modulation. Digital Representation of Analog Signals.

Module-IV	**Digital Modulation**	**10 Hrs**

Digital Modulation: Binary Amplitude Shift Keying, Binary Phase Shift Keying and Quadrature Phase Shift Keying, Binary Frequency Shift Keying. Regenerative Repeater, M-ARY and comparison

Module-V	Communication Systems	10 Hrs
Communication Systems: Satellite, RADAR, Optical, Micro wave communication, Mobile and Computer Communication (Block diagram approach only).		
Text Books: 1. Herbert Taub, Donald L Schilling and Goutam Saha, "Principles of Communication Systems", 3rd Edition, Tata McGraw-Hill Publishing Company Ltd., 2008.		
References: 1. B. P. Lathi, Zhi Ding and Hari M. Gupta, "Modern Digital and Analog Communication Systems", 4th Edition, Oxford University Press, 2017. 2. K. Sam Shanmugam "Digital and Analog Communication Systems", Wiley India Edition, 2008.		
Web References: https://onlinecourses.nptel.ac.in/noc22_ee05/preview		

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APPLICATIONS OF POWER ELECTRONICS TO POWER SYSTEMS

Course Code	L: T:P:S	Credits	Exam. Marks	Exam Duration	Course Type
22A0258T	3:0:0:0	3	CIE:30&SEE:70	3 Hours	OEC

Course Objectives:

This course will enable students to:

1. Develop the understanding of uncompensated lines and their behavior under heavy loading conditions.
2. Understand the concept and importance controllable parameters of FACTS controllers.
3. Emphasize the objectives of Shunt compensation, and basic operation of SVC and STATCOM.

Course Outcomes (COs):

After the completion of the course, the students will be able to:

- Choose proper controller for the specific application based on system requirements
- Understand various systems thoroughly and their requirements
- Interpret the control circuits of Shunt Controllers SVC & STATCOM for various functions viz. Transient stability Enhancement, voltage instability prevention and power oscillation damping

Module-I	General System considerations and FACTS	10Hrs

Transmission Interconnections, Flow of Power in an AC System, Power Flow and Dynamic Stability Considerations of a Transmission Interconnection, Principles of series and shunt compensation, Basic Types of FACTS, Controllers, Benefits from FACTS, Application of FACTS.

Module-II	Shunt Compensators	8Hrs

Objectives of Shunt Compensation, Midpoint Voltage Regulation for Line Segmentation, End of Line Voltage Support to Prevent Voltage Instability, improvement of Transient Stability, Power Oscillation Damping, Static Var Compensators, SVC and STATCOM, The Regulation Slope, Transfer Function and dynamic Performance, Transient Stability, Enhancement and Power Oscillation Damping.

Module-III	Series Compensators	10Hrs

Objectives of Series Compensation, concept of series capacitive compensation, voltage stability, improvement of transient stability, power oscillation damping, GTO thyristor-controlled series capacitor, Thyristor controlled series capacitor, SSSC.

Module-IV	Combined Compensators	10Hrs

Introduction, Unified power flow controller, basic operating principles, independent real and reactive power flow control, and control structure, basic control system for P and Q control.

Module-V	Mitigation of Harmonics	10Hrs
Power quality problems, harmonics, harmonic creating loads, harmonic power flow, and mitigation of harmonics, filters, passive filters, active filters, shunt, series and hybrid filters.		

Text Books:

1. Narain G. Hingorani, Laszlo Gyugyi," Understanding FACTS", IEEE Press
2. Roger. C. Dugan, Mark. F. McGranagham, Surya Santoso, H.Wayne Beaty, "Electrical Power Systems Quality", McGraw Hill,2003

References:

1. Y.H.Song, A.T.Johns," Flexible A.C.Transmission System", IEE, London, 1999 Edition, Pearson, 2010.

Web References:

https://onlinecourses.nptel.ac.in/noc24_ee130/preview

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Building Materials
(ME, CSE, AI&ML, CS, DS, ECE, EEE)

Course Code	L: T:P:S	Credits	Exam marks	Exam Duration	Course Type
22A0149T	3:0:0:0	3	CIE:30 SEE:70	3 Hours	OEC

Course Objectives:

This course will enable students to:

- Identify the traditional materials that are used for building constructions.
- Explain basic concepts of building components such as stair case and masonry
- Know the causes of dampness in structures and its preventive measures
- Understand the building rules, building bye laws and acoustics of building

Course Outcomes (CO):

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

- Understand the characteristics of different building materials(L2)
- Differentiate brick masonry, stone masonry construction and bonds used in construction of walls of buildings(L4)
- Know about the causes of dampness in buildings and its ill effects(L2)
- Understand the principles of planning in buildings(L2)
- Understand building rules and knowledge about, bye-laws and building elements. (L2)

Syllabus		Total Hours:48
Module-I	**Materials**	**9 Hrs**
Traditional materials: Stones- Types of stone masonry -Brick-types of brick masonry- lime Cement – Timber – Seasoning of timber - their uses in building works		
Module-II	**Building Components**	**9 Hrs**
Lintels, Arches and Vaults – Staircases, Lifts – Types. Different types of flooring-Concrete, Mosaic, Terrazo floors; Different types of roofs- Pitched, Flat and Curved Roofs. Lean-to-Roof, Coupled Roofs, Trussed roofs - King and Queen Post Trusses. Doors & Windows- Types and Specifications		
Module -III	**Dampness**	**10 Hrs**
Dampness and its prevention: Causes of dampness- ill effects of dampness-requirements of an ideal material for damp proofing-materials for damp proofing –methods of damp proofing.		
Module-IV	**Building Planning**	**10 Hrs**
Elements of building planning- basic requirements-orientation-planning for energy efficiency-planning based on utility-other requirements		
Module-V	**Building Rules and Bye-Laws**	**10 Hrs**
Zoning regulations; Regulations regarding layouts or subdivisions; Building regulations; Rules for special type of buildings; Calculation of plinth, floor and carpet area; Floor space index. Building Information System		

Textbooks:

1. M.G. Shah, C.M. Kale and S.Y. Patki,"Building Drawing", Tata McGraw-Hill Publications
2. B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain,"Building Construction" - Laxmi Publications (P) Ltd., New Delhi

Reference Books:

1. S. K. Duggal, "Building Materials", New Age International Publications.
2. N. Kumaraswamy, A. Kameswara Rao," Building Planning and Drawing", 7th Ed, Charotar

Web References:

http://nptel.ac.in/courses/105104103/
http://www.academicpub.org/jwrhe/
http://www.peo.on.ca/index.php/ci_id/21843/la_id/1

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AUTOMOBILE ENGINEERING

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0323Ta	3: 0:0:0	3	CIE:30SEE:70	3Hours	OEC

Course Objectives:

This course will enable students to:

- Impart the knowledge of vehicle structure and its components.
- Demonstrate various components of petrol engines and diesel engines.
- Trains about the various electrical system, circuits, and testing of automobiles.
- Explain the concepts of steering, suspension and braking system in automobile.

Course Outcomes (CO):

On completion of this course, student will be able to:

- Identify different parts of automobile(L2)
- Explain the working of various parts like engine and brakes(L2)
- Describe the working of steering and the suspension systems(L2)
- Summarize the wheels and tires(L2)
- Outline the future developments in the automobile industry(L3)

Syllabus		Total Hours:48
Module-I	**Introduction to Vehicle Structure and Engine Components**	**9 Hrs**

Vehicle construction - Chassis and body - Specifications - Engine - Types - Construction - Location of engine - Cylinder arrangement - Construction details - Cylinder block - Cylinder head - Cylinder liners - Piston – piston rings - Piston pin - Connecting rod - Crankshaft - Valves. Lubrication system - Types - Oil pumps - Filters. Crankcase ventilation

Module-II	Ignition and Fuel Supply Systems	10Hrs

Ignition system - Coil and Magneto - Spark plug - Distributor – Electronic ignition system - Fuel system - Carburetor - Fuel pumps - Fuel injection systems - Mono point and Multi point – Unit Injector – Nozzle types - Electronic Fuel Injection system (EFI) – GDI, MPFI, DTSI.

Module-III	Steering and Suspension System	10Hrs

Principle of steering - Steering Geometry and wheel alignment - Steering linkages – Steering gearboxes - Power steering - front axle - Suspension system - Independent and Solid axle – coil, leaf spring and air suspensions - torsion bar - shock absorbers.

Module-IV	Wheels, Tyres and Braking System	9 Hrs

Wheels and Tyres - Construction - Type and specification - Tyre wear and causes - Brakes - Needs – Classification –Drum and Disc Mechanical - Hydraulic and pneumatic - Vacuum assist – Retarders – Anti-lock Braking System (ABS).

Module-V	Automobile Electrical Systems and Advances in Automobile Engineering	10Hrs
Battery-General electrical circuits- Active Suspension System (ASS) - Electronic Brake Distribution (EBD) – Electronic Stability Program (ESP), Traction Control System (TCS) - Global Positioning System (GPS), Hybrid vehicle, Fuel Cell.		

Text Books:

1. Kirpal Singh," Automobile Engineering", Vol.1&2, Standard Publications, 13/e, 2020.
2. William.H.Crouse, "Automotive Mechanics", 10/e , McGraw-Hill, 2006.

Reference Books:

1. David A. Corolla, "Automotive Engineering: Powertrain, Chassis System and Vehicle Body", Butterworth-Heinemann Publishing Ltd, 2009.
2. Richard Stone, Jeffrey K. Ball, "Automotive Engineering Fundamentals", SAE International, 2004
3. Bosch," Automotive Hand Book", 6/e, SAE Publications, 2007.
4. K. Newton and W. Steeds, "The motor vehicle", 13/e, Butterworth-Heinemann Publishing Ltd, 1989.
5. Joseph Heitner, "Automotive Mechanics Principles and Practices", 2/e, CBS publishing 2004

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SOFTWARE ENGINEERING LAB

Course Code	L: T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0510P	0:0:3:0	1.5	CIE:30 SEE:70	3Hours	PCC(Lab)

Course Objectives:

This course will enable students to:

- Learn and implement the fundamental concepts of Software Engineering.
- Explore functional and non-functional requirements through SRS.
- Practice the various design diagrams through the appropriate tool.
- Learn to implement various software testing strategies.

Course Outcomes (COs):

After completion of this course, the students will be able to:

- Acquaint with historical and modern software methodologies(L2)
- Understand the phases of software projects and practice the activities of each phase (L2)
- Practice clean coding (L3)
- Take part in project management(L3)
- Adopt skills such as distributed version control, unit testing, integration testing, build management, and deployment(L3)

Syllabus	Total Hours: 48

List of Experiments

Experiment-1: Draw the Work Breakdown Structure for the system to be automated

Experiment-2: Schedule all the activities and sub-activities Using the PERT/CPM charts

Experiment-3: Define use cases and represent them in use-case document for all the stakeholders of the system to be automated

Experiment-4: Identify and analyze all the possible risks and its risk mitigation plan for the system to be automated

Experiment-5: Diagnose any risk using Ishikawa Diagram (Can be called as Fish Bone Diagram or Cause& Effect Diagram)

Experiment-6: Define Complete Project plan for the system to be automated using Microsoft Project Tool

Experiment-7: Define the Features, Vision, Business objectives, Business rules and stakeholders in the vision document

Experiment-8: Define the functional and non-functional requirements of the system to be automated by using Use cases and document in SRS document

Experiment-9: Define the following traceability matrices: 1. Use case Vs. Features 2. Functional requirements Vs. Use cases
Experiment-10: Estimate the effort using the following methods for the system to be automated: 1. Function point metric 2. Use case point metric
Experiment-11: Develop a tool which can be used for quantification of all the non-functional requirements
Experiment-12: Write C/C++/Java/Python program for classifying the various types of coupling.
Experiment-13: Write a C/C++/Java/Python program for classifying the various types of cohesion.
Experiment-14: Write a C/C++/Java/Python program for object-oriented metrics for design proposed by Chidamber and Kremer. (Popularly called CK metrics)
Experiment-15: Convert the DFD into appropriate architecture styles.
Experiment-16: Draw a complete class diagram and object diagrams using Rational tools
Experiment-17: Define the design activities along with necessary artifacts using Design Document.
Experiment-18: Reverse Engineer any object-oriented code to an appropriate class and object diagrams.
Experiment-19: Test a piece of code that executes a specific functionality in the code to be tested and asserts a certain behavior or state using Junit.
Experiment-20: Test the percentage of code to be tested by unit test using any code coverage tools
Experiment-21: Define appropriate metrics for at least 3 quality attributes for any software application of your interest

Reference Book

Carlos Otero ,"Software Engineering Design : Theory and Practice", CRC press, 2016

Web References

http://vlabs.iitkgp.ernet.in/se/
https://home.adelphi.edu/~chays/csc440/slides.html

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MACHINE LEARNING LAB

(Common to CSE, AI&ML, DS, CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0532P	0:0:3:0	1.5	CIE: 30 SEE:70	3 Hours	PCC(Lab)

Course Objectives:

This course will enable students to:

- Make use of Data sets in implementing the machine learning algorithms
- Implement the machine learning concepts and algorithms in any suitable language of choice.

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand the Mathematical and statistical prospective of machine learning algorithms through python programming (L2)
- Apply different visualization techniques in the data analytics solution(L3)
- Derive insights using Machine learning algorithms(L3)

Syllabus	Total Hours:48

List of Experiments

Experiment 1: Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.

Experiment 2: For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.

Experiment 3: Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

Experiment 4: Build an Artificial Neural Network by implementing the Back-propagation algorithm and test the same using appropriate data sets.

Experiment 5: Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.

Experiment 6: Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.

Experiment 7: Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.

Experiment 8: Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.

Experiment 9: Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.

Experiment 10: Implement parametric and non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

Experiment 11: Implement BIRCH clustering algorithm

Experiment 12: Implement DBSCAN clustering algorithm

Reference Book:

1. Python Machine Learning Workbook for beginners, AI Publishing, 2020

Web References:

https://www.udemy.com/course/machinelearning/

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DATA WRANGLING WITH PYTHON (AI&ML)

Course Code	L: T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A3305P	1:0:2:0	2	100	3Hrs	SC

Course Objectives:

This course will enable students to understand:

- The fundamental concepts of data wrangling and Python basics.
- The concept of data cleaning and formatting of the data.
- The computations with Excel and pdf files.
- The basic data exploration and web scrapping.

Syllabus | **Total Hours: 48**

MODULE–I: INTRODUCTION TO DATA WRANGLING (10 Hrs)

What Is Data Wrangling? Importance of Data Wrangling, how is Data Wrangling performed? Tasks of Data Wrangling, Data Wrangling Tools, Introduction to Python, Python Basics, Data Meant to Be Read by Machines, CSV Data, JSON Data, XML Data.

Experiment – 1: Develop a Python Program for reading and Writing CSV files
Experiment – 2: Develop a Python Program for reading and XML files
Experiment – 3: Develop a Python Program for reading and writing JSON to a file

MODULE–II: WORKING WITH EXCELFILES AND PDFS (10 Hrs)

Installing Python Packages, Parsing Excel Files, Getting Started with Parsing, PDFs and Problem Solving in Python, Programmatic Approaches to PDF Parsing, Converting PDF to Text, Parsing PDFs Using pdf miner, Acquiring and Storing Data, Databases: A Brief Introduction-Relational Databases: MySQL and PostgreSQL, Non-Relational Databases: NoSQL, when to use a Simple File, Alternative Data Storage.

Experiment – 4: Develop a Python Program for reading an excel file
Experiment -- 5: Develop a Python Program for Converting TSV file into Excel
Experiment – 6: Develop a Python Program for converting PDF file into Excel

MODULE–III: DATA CLEANUP (10 Hrs)

Why Clean Data? Data Cleanup Basics, Identifying Values for Data Cleanup, Formatting Data, Finding Outliers and Bad Data, Finding Duplicates, Fuzzy Matching, RegEx Matching.
Normalizing and Standardizing the Data, Saving the Data, determining suitable Data Cleanup, Scripting the Cleanup, Testing with New Data.

Experiment – 7: Develop a Python Program for cleaning empty cells and cleaning wrong format
Experiment – 8: Develop a Python Program for finding duplicates in a data frame

Experiment – 9: Develop a Python Program for normalizing data

MODULE–IV: DATA EXPLORATION AND ANALYSIS (9 Hrs)

Exploring Data, Importing Data, Exploring Table Functions, Joining Numerous Datasets, Identifying Correlations, Identifying Outliers, Creating Groupings, Analyzing Data - Separating and Focusing the Data, Presenting Data, Visualizing the Data, Charts, Time-Related Data, Maps, Interactives, Words, Images, Video, and Illustrations, Presentation Tools, Publishing the Data - Open-Source Platforms.

Experiment – 10: Develop a Python Program for detecting and removing outliers
Experiment – 11: Develop a Python Program for drawing bar chart, histogram and Pie chart
Experiment – 12: Develop a Python Program for time series visualization

MODULE–V: WEB SCRAPING (9 Hrs)

What to Scrape and How, analyzing a Web Page, Network/Timeline, interacting with JavaScript, In-Depth Analysis of a Page, Getting Pages, Reading a Web Page - Reading a Web Page with LXML and XPath, Advanced Web Scraping - Browser-Based Parsing, Screen Reading with Selenium, Screen Reading with Ghost. Py, Spidering the Web - Building a Spider with Scrapy, Crawling Whole Websites with Scrapy
Experiment – 13: Develop a Python Program for reading a HTML page
Experiment – 14: Develop a Python Program for building a Spider using scrapy
.

Text Books:

1. Jacqueline Kazil & Katharine Jarmul," Data Wrangling with Python", O'ReillyMediaInc.,2016.

Reference Books:

1. Dr. Tirtha jyoti Sarkar,Shubha deep, "Data Wrangling with Python: Creating action table data from raw sources", Packt Publishing Ltd., 2019.
2. Stefanie Molin," Hands-On Data Analysis with Pandas", PacktPublishingLtd.,2019
3. AllanVisochek," Practical DataWrangling", PacktPublishingLtd.,2017
4. TyeRattenbury, Joseph M. Hellerstein, Jeffrey Heer, Sean Kandel, Connor Carreras," Principles of Data Wrangling: Practical Techniques for Data Preparation", O'Reilly Media Inc., 2017

Web References:

1. http://www.gbv.de/dms/ilmenau/toc/827365454.PDF
2. https://www.udemy.com/course/data-wrangling-with-python/
3. http://www.openculture.com/free-online-data-science-courses
4. https://www.classcentral.com/course/dataanalysiswithpython-11177

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DESIGN THINKING AND INNOVATION

(Common to CSE, AIML, CS, DS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0526	2:0:0:0	-	CIE:30	-	MC

Course Objectives:

The objective of this course is to familiarize students with design thinking process as a tool for breakthrough innovation. It aims to equip students with design thinking skills and ignite the minds to create innovative ideas, develop solutions for real-time problems.

Course Outcomes (CO):

On completion of this course, student will be able to:

- Define the concepts related to design thinking(L2).
- Interpret the fundamentals of Design Thinking and innovation(L2)
- Apply the Design thinking techniques for solving problems in various sectors(L3)
- Analyze to work in a Multidisciplinary Environment(L4)
- Compute the value of Creativity (L3)
- Formulate specific problem statements of real time issues(L3)

Syllabus		Total Hours:48
Module-I	**Introduction to Design Thinking**	**9Hrs**

Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

Module -II	Design Thinking Process	9Hrs

Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brain storming, product development

Activity: Every student presents their idea in three minutes, every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

Module -III	Innovation	10Hrs

Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations. Creativity to Innovation. Teams for innovation, Measuring the impact and value of creativity.

Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

Module -IV	Product Design	10Hrs

Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications. Innovation towards product design Case studies.

Activity: Importance of modelling, how to set specifications, Explaining their own product design.

Module -V	**Design Thinking in Business Processes**	**10Hrs**

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs.

Design thinking for Startups. Defining and testing Business Models and Business Cases. Developing & testing prototypes. Activity: How to market our own product, About maintenance, Reliability and plan for startup.

Text Books:

1. Tim Brown, Harper Bollins," Change by Design", (2009)
2. Idris Mootee "Design Thinking for Strategic Innovation", 2013, John Wiley & Sons

Reference Books:

1. David Lee, "Design Thinking in the Classroom", Ulysses press
2. Shrrutin N Shetty, "Design the Future",", Norton Press
3. William lidwell, kritinaholden, Jill butter "Universal Principles of Design".

Web References:

https://nptel.ac.in/courses/110/106/110106124/
https://nptel.ac.in/courses/109/104/109104109/
https://swayam.gov.in/nd1_noc19_mg60/preview

Semester-6 (Theory-5, Lab-3, SC-1 MC-1)							
Sl. No.	**Category**	**Course Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	**C**
1	PCC	22A3306T	Natural Language Processing	3	0	0	3
2	PCC	22A3307T	Advanced Machine Learning	3	0	0	3
3	PCC	22A05H04	Computer Vision	3	0	0	3
4	PEC	22A0530Ta 22A0535Tb 22A0530Tc 22A0529T	**Professional Elective-II:** 1. Software Testing 2. Intelligent Information Retrieval Systems 3. Cryptography and Network Security 4. Cloud computing	3	0	0	3
5	OEC	22A0413T 22A0213Ta 22A0150T 22A0327Tb	**Open Elective-II:** 1. Micro Controllers and Applications 2. Control Systems 3. Environmental Economics 4. Introduction to Composite Materials	3	0	0	3
6	PCC(Lab)	22A3308P	Natural Language Processing Lab	0	0	3	1.5
7	PCC(Lab)	22A3309P	Advanced Machine Learning Lab	0	0	3	1.5
8	PCC(Lab)	22A3310P	Computer Vision Lab	0	0	3	1.5
9	SC	22A0029P	**Skill Oriented Course:** Soft Skills	1	0	2	2
10	MC	22A0032T	**Mandatory Course:** Research Methodology	2	0	0	0
				Total credits			**21.5**
Honors / Minor courses (The hours distribution can be3-0-2 or 3-1-0 also)				**4**	**0**	**0**	**4**
Industrial / Research Internship (Mandatory) 2 Months during summer vacation							

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NATURAL LANGUAGE PROCESSING
(Common to CSE, AI&ML, DS& CS)

Course Code	L: T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A3306T	3:0:0:0	3	CIE:30 SEE:70	3 Hours	PCC

Course Objectives:

This course will enable students to:

- Understand approaches to Interpretation of Syntax and Semantics of Natural Languages.
- Understand Current methods for statistical approaches to Machine Translation.
- Understand Language Modeling.
- Understand Machine Learning Techniques used in NLP.
- Apply Fundamental algorithms and techniques in the area of Natural Language Processing (NLP)

Course Outcomes (CO):

On completion of this course, student will be able to:

- Understand the logic behind Natural languages(L2)
- Understand the significance of Syntax and Semantics of Natural Languages(L2)
- Process the Natural Languages(L3)
- Verify the Syntax and Semantics of Languages(L3)
- Design New Natural Languages(L3)

Syllabus		Total Hours:43
Module -I	**Introduction to Natural Language Processing**	**8Hrs**
The Study of Language, Applications of NLP, Evaluating Language Understanding Systems, Different Levels of Language Analysis, Representations and Understanding, Organization of Natural language Understanding Systems, Linguistic Background: An outline of English Syntax.		
Module -II	**Grammars and Parsing**	**8Hrs**
Grammars and Parsing- Top- Down and Bottom-Up Parsers, Transition Network Grammars, Feature Systems and Augmented Grammars, Morphological Analysis and the Lexicon, Parsing with Features, Augmented Transition Networks, Bayes Rule, Shannon game, Entropy and Cross Entropy		
Module -III	**Grammars for Natural Language Processing**	**9Hrs**
Grammars for Natural Language, Movement Phenomenon in Language, Handling questions in Context Free Grammars, Hold Mechanisms in ATNs, Gap Threading, Human Preferences in Parsing, Shift Reduce Parsers, Deterministic Parsers.		
Module -IV	**Interpretation and Modelling**	**9Hrs**

Semantic Interpretation-Semantic & Logical form, Word senses & ambiguity, the basic logical form language, encoding ambiguity in the logical Form, Verbs & States in logical form, Thematic roles, Speech acts &embedded sentences, Defining semantics structure model theory. Language Modelling-Introduction, n-Gram Models, Language model Evaluation, Parameter Estimation, Language Model Adaption, Types of Language Models, Language-Specific Modelling Problems, Multilingual and Cross lingual Language Modelling.

Module -V	**Multilingual Information Retrieval**	**9Hrs**

Multilingual Information Retrieval - Introduction, Document Pre-processing, Monolingual Information Retrieval, CLIR, MLIR, Evaluation in Information Retrieval, Tools, Software and Resources. Multilingual Automatic Summarization - Introduction, Approaches to Summarization, Evaluation, How to Build a Summarizer, Competitions and Datasets

Text Books:

1. James Allen," Natural Language Understanding", 2nd Edition, 2003, Pearson Education.
2. Daniel M.Bikel and Imed Zitouni "Multilingual Natural Language Processing Applications: From Theory to Practice", Pearson Publications.

Reference Books:

1. Akshar Bharathi, Vineet Chaitanya, "Natural Language Processing, A paninian perspective", Prentice –Hall of India.
2. Charniack, Eugene, "Statistical Language Learning", MIT Press, 1993.
3. Jurafsky, Dan and Martin, James, "Speech and Language Processing", 2nd Edition, Prentice Hall, 2008.
4. Manning, Christopher and Henrich, Schutze, "Foundations of Statistical Natural Language Processing", MIT Press,1999.

Web References:

https://www.deeplearning.ai/resources/natural-language-processing/

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ADVANCED MACHINE LEARNING

(Common to CSE, AI&ML, DS, CS)

Course Code	L: T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A3307T	3:0:0:0	3	CIE: 30 SEE:70	3 Hours	PCC

Course Objectives:

This course will enable students to:

- Explore the fundamental concepts required for Data science
- Explain the basic concepts of data science.
- To familiarize with Python libraries for Data Visualization.
- Elucidate various Machine Learning algorithms

Course Outcomes (CO):

On completion of this course, students will be able to

1. Apply dimensionality reduction techniques on various data sets(L3)
2. Analyze various Neural Network topologies to solve complex problems in Deep Belief Networks(L4)
3. Examine the performance of deep architectures with respect to high dimensional input data(L4)
4. Apply Semi Supervised Learning techniques on real time data sets to label the data(L3)
5. Apply Feature Engineering techniques to transform raw data into normalized data(L3)
6. Make use of Python Machine Learning tools to ensemble different models together to solve real – time problems(L3)

Syllabus		Total Hours:44
Module-I	**Unsupervised Machine Learning & Deep Belief Networks**	**10 Hrs**

Principal component analysis, Introducing K-means clustering, self-organizing maps.

Neural Networks – A Primer, Composition of A Neural Network, Network Topologies, Restricted Boltzmann Machine, Introducing the RBM, Applications of the RBM, Deep belief Networks-Training a DBN, Applying the DBN, Validating the DBN.

Module-II	**Stacked Denoising Auto encoders & Convolutional Neural Networks**	**9 Hrs**

Autoencoders: Introduction, Topology, Training, Denoising Autoencoders, Applying a DA,

Stacked Denoising Autoencoders, Applying The SDA, Assessing SDA Performance. **Convolutional Neural Networks:** Introduction To CNN, Understanding The Convnet Topology, Understanding Convent Layers And Pooling Layers, Training A Convent, Applying A CNN.

Module-III	**Semi-Supervised Learning & Text Feature Engineering**	**9 Hrs**

Semi-Supervised Learning: Introduction, understanding semi-supervised learning, Semi-supervised algorithms in action, Self- training, implementing self-training, Finessing your self-training implementation, Contrastive Pessimistic Likelihood Estimation. **Text Feature Engineering:** Introduction, Text Feature Engineering, Cleaning Text Data, Text Cleaning With Beautiful Soup, Managing Punctuation and Tokenizing, Tagging and Categorizing Words, Creating Features from Text Data, Stemming.

Module-IV	**Feature Engineering**	**10 Hrs**

Introduction, creating a feature set, Engineering features for ML applications, using rescaling techniques to improve the learnability of features, creating effective derived variables, reinterpreting non-numeric features, using feature selection techniques, performing feature selection, Feature engineering in practice, acquiring data via RESTful APIs, Testing the performance of our model, Twitter, Deriving and selecting variables using feature engineering techniques.

Module-V	**Ensemble Methods & Additional Python Machine Learning Tools**	**10 Hrs**

Ensemble Methods: Introducing Ensembles, Understanding Averaging Ensembles, Using Bagging Algorithms, Using Random Forests, Applying Boosting Methods, Using XGboost, Using Stacking Ensembles, Using Models in Dynamic Applications, Understanding Model Robustness, Identifying Modeling Risk Factors, Strategies to Managing Model Robustness.
Additional Python Machine Learning Tools: Alternative Development Tools, Introduction to Lasagna, getting to know Lasagne, Introduction to Tensor flow, Knowing when to use these libraries

Text Books:

1. John Hearty, "Advanced Machine Learning with Python", Packt Publishing Ltd, 2016.

Reference Books:

1. T.M. Mitchell, "Machine Learning", McGraw-Hill,1997.
2. Machine Learning, SaikatDutt, Subramanian Chandramouli, Amit Kumar Das, Pearson, 2019.

Web References

1. http://digimat.in/nptel/courses/video/106105152/L01.html

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COMPUTER VISION
(Common to CSE, AI&ML, DS, CS)

Course Code	L: T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A05H04	3: 0:0:0	3	CIE: 30 SEE:70	3 Hrs	PCC

Course Objectives:

This course will enable students to :

- Understand the Fundamental Concepts of vision
- Understand the filtering and image filtering operations
- Understand basic principles of Thresholding.
- Understand the importance of edge detection in computer vision
- Understand the broad concepts of texture

Course Outcomes (COS):

After completion of the course, the students will be able to:

- Understand vision and its concepts(L2)
- Understand the concepts of image filtering (L2).
- Use the Thresholding techniques in image conversion (L3)
- Use image edge detection for smoothing (L3)
- Understand the use of texture in image processing (L2).

Syllabus		Total Hours:48
Module-I	**Vision, the Challenge**	**9Hrs**

Vision, the Challenge: Introduction, The Nature of Vision- The Process of Recognition, Tackling the Recognition Problem, Object Location, Scene Analysis, Vision as Inverse Graphics

Module-II	Imaging and Image Filtering Operations	10 Hrs

Images and Imaging Operations: Introduction, Image Processing Operations, Convolutions and Point Spread Functions. Sequential Versus Parallel Operations.

Basic Image Filtering Operations: Introduction, Noise Suppression by Gaussian Smoothing, Median Filters, Mode Filters, Rank Order Filters, Shifts Introduced by Median Filters, Discrete Model of Median Shifts

Module-III	Thresholding Techniques	9Hrs

Thresholding Techniques: Introduction, Region-Growing Methods, Thresholding, Adaptive Thresholding, More Thoroughgoing Approaches to Threshold Selection, The Global Valley Approach to Thresholding, Practical Results Obtained Using the Global Valley Method.

Module-IV	Edge Detection	10 Hrs

Edge detection: Introduction, Basic Theory of Edge Detection, The Template Matching Approach, Theory of 3 3 3 Template Operators, The Design of Differential Gradient Operators, The Concept of a Circular Operator, Detailed Implementation of Circular Operators, 0 Hysteresis Thresholding, The Canny Operator, The Laplacian Operator, Practical Results Obtained Using Active Contour

Module-V	Texture and Binary Shape Analysis	10 Hrs

Texture: Some Basic Approaches to Texture Analysis, Gray level Co-occurrence Matrices, Laws' Texture Energy Approach, Ade's Eigen filter Approach, Appraisal of the Laws and Ade Approaches

Binary Shape Analysis: Connectedness in Binary Images, Size Filtering, Distance Functions and Their Uses.

Text Books:

1. E. R. Davies, "Machine Vision: Theory, Algorithms, Practicalities" Fourth Edition

Reference Books:

1. David A. Forsyth and Jean Ponce, "Computer Vision – A Modern Approach", PHI Learning (Indian Edition), 2009.
2. R. C. Gonzalez and R. E. Woods "Digital Image Processing" Addison Wesley 2008.
3. Richard Szeliski "Computer Vision: Algorithms and Applications" Springer-Verlag London Limited 2011.

Web References:

1. https://onlinecourses.nptel.ac.in/noc19_cs58/preview

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SOFTWARE TESTING
(Common **to CSE, AI&ML, CS, DS**)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0530Ta	**3:0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**PEC**

Course Objectives:

This course will enable students to:

- Learn the criteria for test cases.
- Learn the design of test cases.
- Understand test management and test automation techniques.
- Apply test metrics and measurements

Course Outcomes (CO):

On completion of this course, student will be able to

- Interpret test cases suitable for a software development for different paths, domains and state graphs. (L2)
- Discover suitable tests to be carried out. (L3)
- Categorize Transaction flow testing and data flow testing. (L4)
- Illustrate Domain testing and Logic based testing. (L2)
- Solve path products and regular expressions. (L3)
- Connect state, state graphs and transition testing. (L4)

Syllabus		**Total Hours:48**
Module-I	**Introduction to Testing**	**10Hrs**

Introduction: Purpose of testing, dichotomies, model for testing, consequences of bugs, taxonomy of bugs. Flow graphs and path testing: Basics concepts of path testing, predicates, path predicates and achievable paths, path sensitizing, path instrumentation, application of path testing.

Module-II	**Transaction Flow Testing**	**9Hrs**

Transaction flow testing: Transaction flows, transaction flow testing techniques, dataflow testing, basics of data flow testing, strategies in data flow testing, application of data flow testing.

Module-III	**Path Products**	**10Hrs**

Domain testing: Domains and paths, nice and ugly domains, domain testing, domains and interfaces testing, domain and interface testing, domains and testability.

Logic based testing: Overview, decision tables, path expressions, kv charts and specifications

Module-IV	**Architecture Requirements and Designing**	**9Hrs**

Paths, path products and regular expressions: Path products and path expression, reduction procedure, applications, regular expressions and flow anomaly detection.

Module-V	Transition Testing	10Hrs
State, state graphs and transition testing: State graphs, good and bad state graphs, state testing, testability tips.		

Text Books:

1. BorisBeizer, “Software Testing Techniques”, DreamtechPress,2nd Edition,2003
2. Srinivasan Desikan and Gopalaswamy Ramesh, “Software Testing Principles and Practices”, Pearson Education, 2006.

Reference Books:

1. Ron Patton,” Software Testing”, Second Edition, Sams Publishing, Pearson Education, 2007.AU Library.com
2. P.C.Jorgenson “Software Testing: A Craft men,, Approach”, Auerbach Publications, 3rd Edition, 2013
3. Perry, “Effective Methods of Software Testing”, JohnWiley,2nd Edition, 1999.
4. P.NageswaraRao”Software Testing Concepts and Tools”, Dream Tech Press, 2nd Edition, 2007.

Web References:

1. https://nptel.ac.in/courses/106105031/

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INTELLIGENT INFORMATION RETRIEVAL SYSTEMS
(Common to CSE, AI&ML, DS, CS)

Course Code	L: T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0535Tb	3:0:0:0	3	CIE:30 SEE:70	3 Hours	PEC

Course Objectives:

This course will enable students to:

- Understand the techniques for retrieval of information
- Discuss indexing and how to use it
- Demonstrate how to automate indexing

Course Outcomes (CO):

After the completion of the course, the students will able to

- Recognize the Boolean Model, Vector Space Model, and Probabilistic Model(L2)
- Understand retrieval utilities(L2)
- Understand different formatting tags(L2)
- Understand cross-language information retrieval(L2)
- Understand different clustering techniques(L2)
- Determine the efficiency of different retrieval systems(L3)

Syllabus		Total Hours:48
Module-I	**Introduction**	**10Hrs**

Introduction to Information Retrieval Systems: Definition of Information Retrieval System, Objectives of Information Retrieval Systems, Functional Overview, Relationship to Database Management Systems, Digital Libraries and Data Warehouses.

Information Retrieval System Capabilities: Search Capabilities, Browse Capabilities, Miscellaneous Capabilities

Module-II	Cataloguing and Indexing, Data structure	9Hrs

Cataloguing and Indexing: History and objectives of Indexing, Indexing Process, Automatic Indexing, Information extraction.

Data structure: Introduction to Data Structure, Stemming Algorithms, Inverted File Structure, N-Gram Data Structures, PAT Data Structure, Signature File Structure, Hypertext and XML Data Structures, Hidden Markov Models.

Module-III	Automatic Indexing, Document and Term Clustering	10Hrs

Automatic Indexing: Classes of Automatic Indexing, Statistical Indexing, Natural Language, Concept Indexing, Hypertext Linkages.

Document and Term Clustering: Introduction to Clustering, Thesaurus Generation, Manual Clustering Automatic Term Clustering, Complete Term Relation Method, Clustering Using Existing Clusters, One Pass Assignments, Item Clustering, hierarchy of Clusters.

Module-IV	Automatic Indexing, Information visualization	9Hrs

Automatic Indexing: Search Statements and Binding, Similarity Measures and Ranking, Relevance Feedback, Selective Dissemination of Information Search, Weighted Searches of Boolean Systems, Searching the INTERNET and Hypertext.

Information Visualization: Introduction to Information visualization, Cognition and perception, Information Visualization Technologies.

Module-V	Text Search Algorithms, Multimedia Information Retrieval, Information System Evaluation	10Hrs

Text Search Algorithms: Introduction to Text Search techniques, software Text Search algorithms, Hardware Text Search Systems.

Multimedia Information Retrieval: Spoken Language Audio Retrieval, Non-Speech Audio Retrieval, Graph retrieval, Imagery Retrieval, Video Retrieval.

Information System Evaluation: Introduction to Information System Evaluation, Measures Used in System Evaluation, Measurement Example- TREC results.

Text Books:

1. Gerald J. Kowalski, Mark T. Maybury, "Information Storage and Retrieval Systems: Theory and Implementation", Springer, 2013.

Reference Books:

1. Frakes, W.B., Ricardo Baeza-Yates," Information Retrieval Data Structures and Algorithms", Prentice Hall, 1992.
2. Yates "Modern Information Retrieval", Pearson Education.
3. Robert Korfhage, "Information Storage & Retrieval" , John Wiley & Sons**.**

Web References:

https://www.tutorialandexample.com/information-retrieval

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CRYPTOGRAPHY AND NETWORK SECURITY

(Common to CSE, AIML, CS, DS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0530Tc	3:0:0:0	3	CIE: 30 SEE:70	3 Hours	PEC

Course Objectives:

This course will enable students to:

- Introduce the basic categories of threats to computers and networks
- Illustrate various cryptographical algorithms.
- Demonstrate public-key cryptosystem.
- Discuss the fundamental ideas of public-key cryptography.
- Explore Web security threats and protection mechanisms.

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand and apply the cryptographic algorithms to safe guard from intruders(L3)
- Compare and contrast symmetric and asymmetric encryption systems and their vulnerability to attack (L4)
- Implement the various key distribution, management and message authentication Schemes to send the messages with security (L3)
- Identify information system requirements for Transport level, wireless network, E-Mail and IP (L3)
- Design a network security system by implementing all the concepts of encryption and decryption algorithms (L3)
- Design a web security system by implementing all the concepts(L3)

Syllabus		Total Hours:48
Module-I	**Attacks on Computers and Computer Security**	**10Hrs**
Introduction, The need for security, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security Cryptography, plain text and cipher text, encryption and decryption, substitution techniques, transposition techniques, symmetric and asymmetric key cryptography, Steganography		
Module-II	**Symmetric key Ciphers & Asymmetric key Ciphers**	**9Hrs**
Symmetric key Ciphers: Block Cipher principles, Block cipher modes of operation, Stream ciphers, DES, AES, Blowfish, Key distribution. **Asymmetric key Ciphers**: Principles of public key cryptosystems, RSA, Diffie Hellman Key Exchange, and Elliptic Curve Cryptography, Key Distribution.		
Module-III	**Message Authentication and Hash Functions**	**10Hrs**
Authentication requirements, Functions, Message authentication codes, Hash Functions, Secure hash algorithm, Whirlpool, HMAC, CMAC, Digital signatures.		
Module-IV	**E-Mail Security**	**9Hrs**

Pretty Good Privacy, S/MIME, IP Security: IP Security overview, IPSecurity architecture, Authentication Header, Encapsulating Security Payload (ESP), Security Associations, Key-Management.

Module-V	Web Security	10Hrs

Web security considerations, Secure Socket Layer and Transport Layer Security, Secure electronic transaction Intruders, Virus and Firewalls: Intruders, Intrusion detection, password management, Virus and related threats, Firewall design principles, Types of firewalls.
Case Studies on Cryptography and security: Secure Inter-branch Payment Transactions, Virtual Elections.

Text Books:

1. William Stallings, "Cryptography and Network Security", 5th Edition, Pearson Education, 2011.
2. Bernard Menezes "Network Security and Cryptography",1st Edition, CENGAGE Learning, 2010.

Reference Books:

1. C K Shyamala, N Harini, Dr T R Padmanabhan, "Cryptography and Network Security",1st Edition, Wiley India Pvt Ltd,2011.
2. Forouzan Mukhopadhyay "Cryptography and Network Security", 2nd Edition, McGrawHill, 2010.
3. Mark Stamp, Wiley India, "Information Security, Principles and Practice", 2ndEdition, Wiley, 2011.

Web References:

1. https://www.tutorialspoint.com/cryptography/index.htm
2. https://www.gatevidyalay.com/tag/cryptography-and-network-security-tutorial/
3. https://www.youtube.com/watch?v=C7vmouDOJYM

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CLOUD COMPUTING
(Common to CSE, AI&ML, DS, CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0529T	3:0:0:0	3	CIE: 30 SEE:70	3 Hours	PEC

Course Objectives:

This course will enable students to:

- Introduce the broad perceptive of cloud architecture and model
- Understand the concept of Virtualization and familiar with the lead players in cloud.
- Understand the features of cloud simulator and apply different cloud programming model
- Design of cloud Services and explore the trusted cloud Computing system

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand the basic concepts about cloud computing vision and its developments and gain the knowledge of virtualization technology(L2)
- Analyze the concepts of cloud services and the deployment models(L4)
- Choose among various cloud technologies for implementing applications (GAE, OpenStack) (L4)
- Construct the virtual machines by using VMware simulator(L3)
- Build scientific applications by using Cloud environment(L3)
- Develop Business and Consumer Applications(L3)

Syllabus		Total Hours:48
Module-I	**Basics of Cloud Computing**	**10Hrs**

Introduction to Cloud: Introduction to Cloud, Cloud Computing Reference Model, Characteristics and Benefits, Challenges Ahead, Elasticity in Cloud, On-demand Provisioning.

Virtualization: Introduction, Characteristics of Virtualized Environment, Taxonomy of Virtualization Techniques, Virtualization, and Cloud computing.

Module-II	Cloud Architecture, Models and Security	9Hrs

Cloud Computing Architecture: Introduction, Cloud Reference Model, Architecture, Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds.

Cloud Deployment Model: Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Economics of the Cloud.

Module-III	Cloud Technologies and Advancements	10Hrs

Apache Hadoop, MapReduce, Hadoop Cluster setup, Virtual Box, Google App Engine, Programming Environment for Google App Engine – Open Stack

Module-IV	VMware Simulator	9Hrs

VMWare: Basics of VMWare, Advantages of VMware virtualization, create a new virtual machine on local host, cloning virtual machines, virtualize a physical machine, starting and stopping a virtual machine.

Module-V	Cloud Applications	10Hrs

Cloud Applications: Scientific Applications – Health Care, Geoscience.

Business And Consumer Applications - CRM and ERP, Social Networking, Media Applications, and Multiplayer Online Gaming.

Text Books:

1. Rajkumar Buyya, Christian Vecchiola, S.Thamarai Selvi "Mastering Cloud Computing" ,TMH 2013.
2. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud" O'Reilly Media

Reference Books:

1. Judith Hurwitz , Robin Bloor , Marcia Kaufman ,Fern Halper, "Cloud computing for dummies" Wiley Publishing, Inc, 2010.
2. Rajkumar Buyya, James Broberg, Andrzej Goscinski,"Cloud Computing (Principles and Paradigms)", John Wiley & Sons, Inc. 2011.
3. Gautam Shroff, "Enterprise Cloud Computing", Cambridge University Press, 2010.
4. George Reese,"Cloud Application Architectures: Building Applications and Infrastructure in the Cloud", O 'Reilly, SPD, RP 2011.
5. K.Chandrasekaran ,"Essentials of Cloud Computing", CRC Press.
6. Arshdeep Bahga and Vijay Madisetti," Cloud computing: A Hands-On Approach"
7. Anthony T.Velte , Toby J. Velte Robert Elsenpeter ,"Cloud computing a practical approach", Tata McGraw- Hill , New Delhi – 2010.

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MICRO CONTROLLERS AND APPLICATIONS

(Common to CSE, AI&ML, DS, CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0413T	3:0:0:0	3	CIE: 30 SEE:70	3 Hours	OEC

Course Objectives:

This course will enable students to:

- Describe the Architecture of 8051 Microcontroller and Interfacing of 8051 to external memory.
- Write 8051 Assembly level programs using 8051 instruction set.
- Describe the Interrupt system, operation of Timers/Counters and Serial port of 8051.
- Interface simple switches, simple LEDs, ADC 0804, LCD and Stepper Motor to 8051

Course Outcomes (CO):

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

- Understand the importance of Microcontroller(L2)
- Acquire the knowledge of Architecture of 8051 Microcontroller(L2)
- Apply and Interface simple switches, simple LEDs, ADC 0804, LCD and Stepper Motor to using 8051 I/O ports(L3)
- Develop the 8051 Assembly level programs using 8051 instruction set(L3)
- Develop the Interrupt system(L3)
- Understand the operation of Timers/Counters and Serial port of 8051(L2)

Syllabus		Total Hours:48
Module-I	**8051 Microcontroller**	**10Hrs**

8051 Microcontroller: Microprocessor Vs Microcontroller, Embedded Systems, Embedded Microcontrollers, 8051 Architecture- Registers, Pin diagram, I/O ports functions, Internal Memory organization. External Memory (ROM & RAM) interfacing..

Module-II	**Addressing Modes**	**9Hrs**

Addressing Modes, Data Transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Bit manipulation instructions. Simple Assembly language program examples to use these instructions.

Module-III	**8051 Stack, Stack and Subroutine instructions**	**9Hrs**

8051 Stack, Stack and Subroutine instructions: Simple Assembly language program examples to use subroutine instructions.8051 Timers and Counters – Operation and Assembly language programming to generate a pulse using Mode-1 and a square wave using Mode- 2 on a port pin.

Module-IV	**8051 Serial Communication**	**10Hrs**

8051 Serial Communication- Basics of Serial Data Communication, RS- 232 standard, 9 pin RS232 signals, Simple Serial Port programming in Assembly and C to transmit a message and to receive data

serially.8051 Interrupts. 8051 Assembly language programming to generate an external interrupt using a switch.		
Module-V	**8051 C programming**	**10Hrs**
8051 C programming to generate a square waveform on a port pin using a Timer interrupt. Interfacing 8051 to ADC-0804, DAC, LCD and Interfacing with relays and Opto isolators, Stepper Motor Interfacing, DC motor interfacing, PWM generation using 8051.		

Text Books:

1. Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; "The 8051 Microcontroller and Embedded Systems – using assembly and C", PHI, 2006 / Pearson, 2006.
2. Kenneth J. Ayala, "The 8051 Microcontroller", 3rd Edition, Thomson/Cengage Learning

Reference Books:

1. Manish K Patel, "The 8051 Microcontroller Based Embedded Systems", McGraw Hill, 2014, ISBN: 978-93-329-0125-4.
2. Raj Kamal, "Microcontrollers: Architecture, Programming, Interfacing and System Design", Pearson Education, 2005. Wayne Wolf, FPGA based system design, Prentice hall, 2004.

Web References:

https://nptel.ac.in/courses/117104072

https://onlinecourses.nptel.ac.in/noc22_ee12/preview

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CONTROL SYSTEMS

(Common to CSE, AI&ML, DS, CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0213Ta	3:0:0:0	3	CIE: 30 SEE:70	3 Hours	OEC

Course Objectives:

This course will enable students to:

- Merits and demerits of open loop and closed loop systems; the effects of feedback
- The use of block diagram algebra and Mason's gain formula
- Transient and steady state responses, time domain specifications
- Frequency domain specifications, Bode diagrams and Nyquist plots
- The fundamental aspects of modern control

Course Outcomes (CO):

On completion of this course, student will be able to

- Compute the effective transfer function of a system from (i) block diagram reduction techniques (ii) Mason's gain formula(L3)
- Compute the steady state errors and transient response characteristics(L3)
- Determine the absolute stability and relative stability of a system(L3)
- Design a compensator to accomplish desired performance(L3)
- Derive state space model of a given physical system and solve the state equation(L3)

Syllabus		Total Hours:48
Module-I	**Introduction**	**10Hrs**

Open Loop and closed loop control systems and their differences- Examples of control systems- Classification of control systems, Feedback Characteristics, Effects of positive and negative feedback. Mathematical models – Differential equations of Translational and Rotational mechanical systems, and Electrical Systems, Block diagram reduction methods – Signal flow graph - Reduction using Mason's gain formula. Transfer Function of DC Servo motor - AC Servo motor - Synchro transmitter and Receiver.

Module-II	**Time Response Analysis**	**10Hrs**

Step Response - Impulse Response - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants

Module-III	**Stability**	**9Hrs**

The concept of stability – Routh's stability criterion – Stability and conditional stability – limitations of Routh's stability. The root locus concept - construction of root loci effects of adding poles and zeros to G(s)H(s) on the root loci.

Module-IV	Frequency Response Analysis	10Hrs
Introduction, Frequency domain specifications-Bode Diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram Stability Analysis from Bode Plots. Polar Plots- Phase margin and Gain Margin-Stability Analysis.		
Module-V	**State Space Analysis**	**10Hrs**
Concepts of state, state variables and state model, derivation of state models from differential equations. Transfer function models. Block diagrams. Diagonalization. Solving the Time invariant state Equations- State Transition Matrix and its Properties. System response through State Space models. The concepts of controllability and observability		

Text Books:

1. Katsuhiko Ogata, "Modern Control Engineering", Pearson, 1st Impression 2015.
2. I. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International Publishers, 5th edition, 2007, Reprint 2012.

Reference Books:

1. Farid Golnaraghi and Benjamin. C. Kuo, "Automatic Control Systems", WILEY, 9th Edition, 2010.
2. Dhanesh N. Manik," Control Systems",CENGAGE Learning, 2012.
3. John J D'Azzo and C. H. Houpis , "Linear Control System Analysis and Design: Conventional and Modern", McGraw - Hill Book Company, 1988.

Web References:

https://archive.nptel.ac.in/courses/107/106/107106081/

https://onlinecourses.nptel.ac.in/noc20_ee90/preview

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ENVIRONMENTAL ECONOMICS
(Common to CSE, AI&ML, DS, CS)

Course Code	L: T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0150T	3:0:0:0	3	CIE:30 SEE:70	3 Hours	OEC

Course Objectives:

This course will enable students to:

- Impart knowledge on sustainable development and economics of energy
- Understand environmental degradation and economic analysis of degradation
- Inculcate the knowledge of economics of pollution and their management
- Demonstrate the concept of cost benefit analysis of environmental resources
- Make the students to understand principles of economics of biodiversity

Course Outcomes (CO):

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

- Understand sustainable development and economics of energy(L2)
- Gain knowledge on environmental degradation and economic analysis of degradation(L2)
- Understand economics of pollution and their management(L2)
- Interpret cost benefit analysis of environmental resources(L2)
- Understand the principles of economics of biodiversity (L2)

Syllabus		Total Hours:48
Module-I	**Sustainable Development**	**9Hrs**
Introduction to sustainable development - Economy-Environment interlinkages - Meaning of sustainable development - Limits to growth and the environmental Kuznets curve – The sustainability debate - Issues of energy and the economics of energy.		
Module-II	**Environmental Degradation**	**9Hrs**
Economic significance and causes of environmental degradation - The concepts of policy failure, externality and market failure - Economic analysis of environmental degradation – Equi –marginal principle.		
Module-III	**Economics of Pollution**	**10Hrs**
Economics of optimal pollution, regulation, monitoring and enforcement - Managing pollution using existing markets: Bargaining solutions – Managing pollution through market intervention: Taxes, subsidies and permits.		
Module-IV	**Cost – Benefit Analysis**	**10Hrs**
Cost – Benefit Analysis: Economic value of environmental resources and environmental damage - Concept of Total Economic Value - Alternative approaches to valuation – Cost-benefit analysis and discounting.		
Module-V	**Economics of Biodiversity**	**10Hrs**

Economics of biodiversity: Economics of biodiversity conservation - Valuing individual species and diversity of species -Policy responses at national and international levels. Economics of Climate Change – stern Report

Text Books:

1. N. Hanley, J. Shogren and B. White," An Introduction to Environmental Economics", Oxford University Press. (2001)
2. D.W. Pearce, A. Markandya and E.B. Barbier, "Blueprint for a Green Economy", Earthscan, London. (1989)

Reference Books:

1. R.K. Turner, D.W. Pearce, I. Bateman and Harvester Wheatsheaf," Environmental Economics: An Elementary Introduction", London. (1994).
2. D.W. Pearce, R.K. Turner and Harvester Wheat sheaf, "Economics of Natural Resources and the Environment", London. (1990).

Web Resources:

https://nptel.ac.in/courses/109107171

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INTRODUCTION TO COMPOSITE MATERIALS

(Common to CSE, AI&ML, DS, CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0327Tb	3:0:0:0	3	CIE:30 SEE:70	3 Hours	OEC

Course Objectives:

This course will enable students to:

- Be familiar with classification and characteristics of composite material and their applications.
- Gain the knowledge about manufacturing methods of composites.
- Know the testing methods related to composite materials.

Course Outcomes (CO):

On completion of this course, the students will be able to:

- Acquire the exposure of different materials(L2)
- Get knowledge on manufacturing and testing methods of composites(L2)
- Understand the mechanical behavior of composites(L2)
- Understand about laminates(L2)
- Understand various joining methods and Failure theories(L2)

Syllabus		Total Hours:48
Module-I	**Introduction**	**10Hrs**
Definitions, Composites, Reinforcements and matrices, Types of reinforcements, Types of matrices, Types of composites, Carbon Fibre composites, Properties of composites in comparison with standard materials, Applications of metal, ceramic and polymer matrix composites.		
Module-II	**Manufacturing Methods**	**9Hrs**
Hand and spray lay - up, injection molding, resin injection, filament winding, pultrusion, centrifugal casting and prepregs. Fibre/Matrix Interface, mechanical. Measurement of interface strength.		
Module-III	**Mechanical Properties**	**9Hrs**
Stiffness and Strength: Geometrical aspects – volume and weight fraction. Unidirectional continuous fibre, discontinuous fibers, Short fiber systems, woven reinforcements –Mechanical Testing: Determination of stiffness and strengths of unidirectional composites; tension, compression, flexure and shear.		
Module-IV	**Laminates**	**10Hrs**
Plate Stiffness and Compliance, Assumptions, Strains, Stress Resultants, Plate Stiffness and Compliance, Computation of Stresses, Types of Laminates -, Symmetric Laminates, Anti-symmetric Laminate, Balanced Laminate, Quasi-isotropic Laminates, Crossply Laminate, Angle-ply Laminate. Orthotropic Laminate, Laminate Moduli, Hygrothermal Stresses.		

Module-V	Joining Methods and Failure Theories	10Hrs
Joining –Advantages and disadvantages of adhesive and mechanically fastened joints. Typical bond strengths and test procedures.		
Text Books: 1. K.K. Chawla, "Composite Materials", Springer-Verlag, New York (1998). 2. B.Tomas Astrom , "Manufacturing of Polymer Composites", CRC Press 2018.		
Reference Books: 1. Stuart M Lee, J. Ian Gray, Miltz" Composites Technology", CRC press (1989). 2. Frank L Matthews and R D Rawlings, "Composite Materials: Engineering and Science", Taylor and Francis (2006),		

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NATURAL LANGUAGE PROCESSING LAB
(Common to CSE, AI&ML, DS, CS)

Course Code	L: T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A3308P	0: 0:3:0	1.5	CIE: 30 SEE:70	3Hours	PCC(Lab)

Course Objectives:

This course will enable students to:

- Introduce the students with the basics of NLP which will empower them for developing advanced NLP tools and
- Solving practical problems in the field of Natural Language Processing.

Course Outcomes (CO):

On completion of this course, the studenst will be able to:

- Understand approaches to syntax and semantics in NLP(L2)
- Analyze grammar formalism and context free grammars(L4)
- Apply the statistical estimation and statistical alignment models(L3)
- Apply Rule based Techniques, Statistical Machine translation (SMT), Word alignment, Phrase based translation (L3)
- Have the skills (experience) of solving specific NLP tasks, which may involve programming in Python, as well as running experiments on textual data. (L3)

Syllabus	Total Hours:48

List of Experiments:

Experiment-1: Word Analysis

Experiment-2: Word Generation

Experiment-3: Morphology

Experiment-4: N-Grams

Experiment-5: N-Grams Smoothing

Experiment-6: POS Tagging: Hidden Markov Model

Experiment-7: POS Tagging: Viterbi Decoding

Experiment-8: Building POS Tagger

Experiment-9: Chunking

Experiment-10: Building Chunker

Reference Books:

1. James Allen, "Natural Language Understanding", 2nd Edition, 2003, Pearson Education.
2. Akshar Bharathi, Vineet Chaitanya, "Natural Language Processing: A paninian perspective", Prentice –Hall of India.

Web References:

1. Welcome to Virtual Labs - A MHRD Govt of india Initiative (vlabs.ac.in)
2. Natural Language Processing in TensorFlow | Coursera

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Advanced Machine Learning Lab (AI & ML)

Course Code	L: T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A3309P	0:0:3:0	1.5	CIE: 30 SEE:70	3Hours	PCC(Lab)

Course Objectives:

This course will enable students to:

- Study various learning algorithms
- Make use of Data sets in implementing the machine learning algorithms
- Implement the machine learning concepts and algorithms in any suitable language ofchoice
- Learn about feature engineering
- To develop skills of using recent machine learning packages for solving practical problems.

Course Outcomes:

On completion of this course, the students will be able to:

- Apply Supervised Learning techniques to deal with unlabelled data(L3)
- Apply Unsupervised Learning techniques to handle complex data(L3)
- Apply Regression techniques for prediction of numerical feature values(L3)
- Analyze data using python libraries Implement an end to end Machine Learning System(L4)

Syllabus — **Total Hours:48**

1. The probability that it is Friday and that a student is absent is 3 %. Since there are 5 school daysin a week, the probability that it is Friday is 20 %. What is the probability that a student is absent given that today is Friday? Apply Baye's rule in python to get the result.
2. Create a K-Means Clustering Algorithm from Scratch in Python?
3. Implement k-nearest neighbours classification using python
4. Given the following data, which specify classifications for nine combinations of VAR1 and VAR2 predict a classification for a case where VAR1=0.906 and VAR2=0.606, using the resultof k-means clustering with 3 means (i.e., 3 centroids) VAR1 VAR2 CLASS 1.713 1.586 0 0.180 1.786 1 0.353 1.240 1 0.940 1.566 0 1.486 0.759 1 1.266 1.106 0 1.540 0.419 1 0.459 1.799 1 0.773 0.186 1
5. The following training examples map descriptions of individuals onto high, medium and low credit-worthiness.

Income	Recreation	Job	Status	Age group	Home - owner	Risk
Medium	skiing	design	single	twenties	no	High risk
High	golf	trading	married	forties	yes	Low risk
Low	speedway	transport	married	thirties	yes	Med risk

Medium	football	banking	single	thirties	yes	Low risk
High	flying	media	married	fifties	yes	High risk
Low	football	security	single	twenties	no	Med risk
Medium	golf	media	single	thirties	yes	Med risk
Medium	golf	transport	married	forties	yes	Low risk
High	skiing	banking	single	thirties	yes	High risk
Low	golf	unemployed	married	forties	yes	High risk

Input attributes are (from left to right) income, recreation, job, status, age group, home-owner. Find the unconditional probability of `golf' and the conditional probability of `single' given `med Risk' in the dataset?

6. Implement linear regression using python.
7. Build an Artificial Neural Network by implementing the Back-propagation algorithm and testthe same using appropriate data sets.
8. Implement Naïve Bayes' theorem to classify the English text
9. Use the appropriate dataset for implementing feature engineering for machine learning to find
   - Missing data imputation
   - Categorical encoding
   - Outliers
   - Feature scaling
   - Mixed variables
10. Design an Optical Character Recognizer

References:

1. John hearty, "Advanced Machine Learning with python" ,2016
2. Aurelian Ger," Hands-On Machine Learning with Scikit-Learn and Tensor Flow" (2nd Edition), 2020
3. Y. S. Abu-Mostafa, M. Magdon-Ismail, H.-T. Lin, "Learning from Data: A Short Course", First Edition, 2012
4. C. M. Bishop," Pattern Recognition and Machine Learning", First Edition. Springer, 2006. (Second Indian Reprint, 2015).
5. S. J. Russell, P. Norvig," Artificial Intelligence: A Modern Approach", Third Edition, Prentice- Hall, 2010.

Online Learning Resources/Virtual Labs:

https://github.com/jiadaizhao/Advanced-Machine-Learning-Specialization.

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COMPUTER VISION LAB					
Course Code	**L: T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A3310P	**0:0:3:0**	**1.5**	**CIE: 30 SEE:70**	**3Hours**	**PCC(Lab)**

Course Objectives:

On completion of this course, the students are able to:

- Study the fundamentals, mathematical transforms necessary for Image Processing
- Understand various Image processing techniques
- Apply different transformation techniques on images

Syllabus	**Total Hours:48**

1. Develop a Python program to convert RGB image into Grayscale Image
2. Develop a Python Program to perform Thresholding on an Input Image
3. Develop a Python Program to perform gray level Slicing without background
4. Develop a Python Program to perform gray level Slicing with background
5. Develop a Python Program to perform Bit Plane Slicing
6. Develop a Python Program to display Histogram of an Image
7. Develop a Python Program to perform Log transformation of an Image
8. Develop a Python Program to implement an Ideal Low Pass Filter
9. Develop a Python Program to implement Butterworth Low Pass Filter
10. Develop a Python Program for detecting edges of an Image
11. Develop a Python Program for blurring an Image
12. Develop a Python Program for overlaying an image on another image
13. Develop a Python for extracting text from an Image

References:

Jan Erik Solem "Programming Computer Vision with Python ", Creative Commons

Online Learning Resources/Virtual Labs:

https://neptune.ai/blog/image-processing-python

https://www.tutorialspoint.com/image-processing-in-python

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SOFT SKILLS (SKILL)
(Common to CSE, AI&ML, DS, CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0029P	1:0:2:0	2	CIE: 30 SEE:70	3 Hours	SC

Course Objectives:

This course will enable students to:

- Encourage all round development of the students by focusing on soft skills.
- Make the students aware of critical thinking and problem-solving skills.
- Develop leadership skills and organizational skills through group activities.
- Function effectively with heterogeneous teams.

Course Outcomes (CO):

On completion of this course, student will be able to

- Memorize various elements of effective communicative skills(L1)
- Interpret people at the emotional level through emotional intelligence(L2)
- Apply critical thinking skills in problem solving(L3)
- Analyze the needs of an organization for team building(L4)
- Judge the situation and take necessary decisions as a leader(L4)
- Develop social and work-life skills as well as personal and emotional well-being(L3)

Syllabus		Total Hours:48
Module-I	**Soft Skills & Communication Skills**	**10Hrs**

Introduction, meaning, significance of soft skills –Vital Components of communication skills - Inter-personal skills - Verbal and Non-verbal Communication.

Activities: Narration about self- strengths and weaknesses- clarity of thought - Interpersonal Skills- Group Discussion – Debate – Mutual Understanding - Book and film Reviews by groups - Group leader presenting views (non- controversial and secular) on contemporary issues or on a given topic. Verbal Communication- Oral Presentations- Extempore- brief addresses and speeches- Negotiation skills – Role Play- Non-verbal communication – Public speaking – Mock interviews – Anchoring Skills..

Module-II	Critical Thinking	9Hrs

Active Listening – Observation – Curiosity – Introspection – Analytical Thinking – Open-mindedness – Creative Thinking.

Activities: Gathering information and statistics on a topic - sequencing – assorting – reasoning – critiquing issues – placing the problem – finding the root cause - seeking viable solution – judging with rationale – evaluating the views of others - Case Study, Story Analysis.

Module-III	Problem Solving & Decision Making	10Hrs

Meaning & features of Problem Solving – Managing Conflict – Conflict resolution – Methods of decision making – Effective decision making in teams – Methods & Styles.

Activities: Placing a problem which involves conflict of interests, choice and views – formulating the problem – exploring solutions by proper reasoning – Discussion on important professional, career and organizational decisions and initiate debate on the appropriateness of the decision. Case Study & Group Discussion.

Module-IV	Emotional Intelligence & Stress Management	9Hrs

Managing Emotions – Thinking before Reacting – Empathy for Others – Self-awareness – Self-Regulation – Stress factors – Controlling Stress – Tips.

Activities: Providing situations for the participants to express emotions such as happiness, enthusiasm, gratitude, and sympathy, and confidence, compassion in the form of written or oral presentations. Providing opportunities for the participants to narrate certain crisis and stress –ridden situations caused by failure, anger, jealousy, resentment and frustration in the form of written and oral presentation, Organizing Debates.

Module-V	Leadership Skills	10Hrs

Team-Building – Decision-Making – Accountability – Planning – Public Speaking – Motivation – Risk Taking - Team Building - Time Management.

Activities: Forming group with a consensus among the participants- choosing a leader- encouraging the group members to express views on leadership- democratic attitude- sense of sacrifice – sense of adjustment – vision – accommodating nature- eliciting views on successes and failures of leadership using the past knowledge and experience of the participants, Public Speaking, Activities on Time Management, Motivation, Decision Making, Group discussion etc.

Text Books:

1. , MitraBarunK, “Personality Development and Soft Skills” Oxford University Press; PAP/CDR edition (July 22, 2012)
2. Dr Shikha Kapoor,” Personality Development and Soft Skills: Preparing for Tomorrow”, I K International Publishing House; 0 edition (February 28, 2018)

Reference Books:

1. Prashant Sharma, “Soft skills: personality development for life success”, BPB publications 2018.
2. Alex K, “Soft Skills”, S. Chand
3. Gajendra Singh Chauhan, Sangeetha Sharma, “Soft Skills: An Integrated Approach to Maximize Personality “Published by Wiley.
4. A. Sharma,” Communication Skills and Soft Skills”, Yking books
5. RenuShorey,” SOFT SKILLS for a BIG IMPACT”, Notion Press.
6. Life Skills Paperback English Dr. Rajiv Kumar Jain, Dr. Usha Jain Publisher: Vayu Education of India

Web Resources:

1. https://youtu.be/DUlsNJtg2L8?list=PLLy_2iUCG87CQhELCytvXh0E_y-bOO1_q
2. https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7KlJ
3. https://youtu.be/-Y-R9hDl7lU
4. https://youtu.be/gkLsn4ddmTs
5. https://youtu.be/2bf9K2rRWwo
6. https://youtu.be/FchfE3c2jzc

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RESEARCH METHODOLOGY

(Common **to CSE, AI&ML, CS, DS, ECE, EEE, ME**)

Course Code	L: T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0032T	**2:0:0:0**	**0**	**CIE: 30**	**-**	**MC**

Course Objectives:

This course will enable students to:

- Understand the basic concepts of research and research problem
- Make the students learn about various types of data collection and sampling
- Design to enable them to know the method of statistical evaluation
- Make the students understand various testing tools in research
- Make the student learn how to write a research report
- Create awareness on ethical issues n research

Course Outcomes (CO):

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

- Understand basic concepts of research and its methodologies(L2)
- Understand the concept of sampling and sampling design(L2)
- Design survey questionnaires for different kinds of research(L3)
- Read, comprehend and explain research articles in their academic discipline(L2)
- Analyze various types of testing tools used in research(L4)
- Develop a research paper without any ethical issues(L3)

Syllabus		**Total Hours:48**
Module-I	**Introduction to Research Methodology**	**10Hrs**

Meaning of Research – Objectives of Research – Types of Research – Research Approaches – Guidelines for Selecting and Defining Research Problem – Research Design – Concepts related to Research Design – Basic Principles of Experimental Design.

Module-II	**Sampling and Data Collection Methods**	**9Hrs**

Sampling Design – steps in Sampling Design –Characteristics of a Good Sample Design – Random Sampling Design. Measurement and Scaling Techniques-Errors in Measurement – Tests of Sound Measurement – Scaling and Scale Construction Techniques – Time Series Analysis – Interpolation and Extrapolation. Data Collection Methods – Primary Data – Secondary data – Questionnaire Survey and Interviews.

Module-III	**Correlation**	**10Hrs**

Correlation and Regression Analysis – Method of Least Squares – Regression vs Correlation – Correlation vs Determination – Types of Correlations and Their Applications

Module-IV	Statistical Inference	9Hrs
Statistical Inference: Tests of Hypothesis – Parametric vs Non-parametric Tests – Hypothesis Testing Procedure – Sampling Theory – Sampling Distribution – Chi-square Test – Analysis of variance and Co-variance – Multivariate Analysis		
Module-V	**Report Writing**	**10Hrs**
Report Writing and Professional Ethics: Interpretation of Data – Report Writing – Layout of a Research Paper – Techniques of Interpretation- Making Scientific Presentations in Conferences and Seminars – Professional Ethics in Research		

Text Books:

1. C.R.Kothari, "Research Methodology:Methods and Techniques",2nd edition, New Age International Publishers.
2. Ranjit Kumar, "A Step by Step Guide for Beginners :Research Methodology" , Sage Publications

Reference Books:

1. P.Narayana Reddy and G.V.R.K.Acharyulu, "Research Methodology and Statistical Tools", 1st Edition, Excel Books,New Delhi.
2. Donald R. "Business Research Methods", Cooper & Pamela S Schindler, 9th edition.
3. S C Gupta, "Fundamentals of Statistics", 7th edition Himalaya Publications

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