GEETHANJALI INSTITUTE OF SCIENCE & TECHNOLOGY
Unit of USHODAYA EDUCATIONAL SOCIETY
An ISO 9001:2015 certified Institution: Recognized under Sec. 2(f)& 12(B) of UGC Act, 1956
3rd Mile, Bombay Highway, Gangavaram (V), Kovur(M), SPSR Nellore (Dt), Andhra Pradesh, India- 524137
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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**

Semester-5 (Theory-5, Lab-2, SC-1, MC-1)

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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 Є-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:

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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:
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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/

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:

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Sl. No.	Category	Course Code	Course Title	L	T	P	C
			Semester-6 (Theory-5, Lab-3, SC-1 MC-1)				
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

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

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/

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.

Web References:
https://nptel.ac.in/courses

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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

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

Web Reference:

https://onlinecourses.swayam2.ac.in/cec20_hs17/preview

https://onlinecourses.nptel.ac.in/noc22_ge08/preview

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Unit of USHODAYA EDUCATIONAL SOCIETY
An ISO 9001:2015 certified Institution: Recognized under Sec. 2(f)& 12(B) of UGC Act, 1956
3rd Mile, Bombay Highway, Gangavaram (V), Kovur(M), SPSR Nellore (Dt), Andhra Pradesh, India- 524137
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Sl. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	**T**	**P**	**C**
1	HSC	22A0023T 22A0024T 22A0025T	**Humanity Science Elective – I:** 1. Management Science 2. Entrepreneurship and Innovation 3. Business Environment	3	0	0	3
2	PEC	22A0534Ta 22A3311Tb 22A0534Tc 22A3312Td	**Professional Elective-III:** 1. Software Project Management 2.Social Network Analysis 3. Internet of Things 4. Fog Computing	3	0	0	3
3	PEC	22A3313Ta 22A3314Tb 22A0535Tc 22A3315Td	**Professional Elective-IV:** 1.Speech Recognition and Synthesis 2.Data Science 3.Adhoc and Wireless Sensor Networks 4.Cloud Security	3	0	0	3
4	PEC	22A3316Ta 22A0534Tb 22A0536Tc 22A3317Td	**Professional Elective-V:** 1. Large language model 2. Big Data Technologies 3. Block chain Technology 4. High Performance Computing	3	0	0	3
5	OEC	22A0241Ta 22A0432T 22A0151T 22A0327Tc	**Open Elective-III:** 1. Smart Grid 2. Basic VLSI Design 3. Disaster management 4. Measurements and Mechatronics	3	0	0	3
6	OEC	22A0232Ta 22A0433T 22A0152T 22A0331Tc	**Open Elective-IV:** 1. Electric Vehicles 2. Industrial Electronics 3. Construction Management 4. Introduction to Robotics	3	0	0	3
7	SC	22A3318P	**Skill Advanced Course:** Generative AI	1	0	2	2
Industrial / Research Internship 2 Months (Mandatory) after Third year (to be evaluated during VII semester)				0	0	0	3

Semester-7 (Theory-6, SC-1)

		Total credits	23
Honors / Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)	**4**	**0**	**0**	**4**

Category	Credits
Professional Elective Courses (PEC)	9
Humanities and Social Science Course (HSC)	3
Open Elective Courses (OEC)	6
Skill Advanced Course (SC)	2
Industrial / Research Internship	3
Total	23

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MANGEMENT SCIENCE						
(Common to CSE, AI&ML, DS, CS, CE)						
Course Code	**L: T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0023T	**3:0:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**HSC**

Course Objectives:

This course will enable students to:

- Gain fundamental knowledge on Management, Administration, Organization & its concepts.
- Understand the role of management in Production
- Understand the concept of HRM in order to have an idea on Recruitment, Selection, Training & Development, job evaluation and Merit rating concepts.
- Be aware of identify Strategic Management areas & the PERT/CPM for better Project Management.
- Be aware of the contemporary issues in management.

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand the concepts & principles of management and designs of organization in a practical world(L2)
- Apply the knowledge of Work-study principles & Quality Control techniques in industry(L3)
- Analyze the concepts of HRM in Recruitment, Selection and Training & Development(L4)
- Evaluate PERT/CPM Techniques for projects of an enterprise and estimate time & cost of project & to analyze the business through SWOT(L4)
- Create Modern technology in management science(L3)

Syllabus		**Total Hours:48**
Module – I	**Introduction To Management**	**10 Hrs**
Management - Concept and meaning - Nature-Functions - Management as a Science and Art and both. Schools of Management Thought - Taylor's Scientific Theory-Henry Fayol's principles -Eltan Mayo's Human relations - Systems Theory - Organizational Designs - Line organization –Line & Staff Organization-Functional Organization-Matrix Organization-Project Organization-Committee form of Organization-Social responsibilities of Management.		
Module – II	**Operations Management**	**10 Hrs**
Principles and Types of Plant Layout - Methods of Production (Job, batch and Mass Production),Work Study-Statistical Quality Control-Deming's contribution to Quality. Material Management - Objectives - Inventory-Functions - Types, Inventory Techniques - EOQ-ABC Analysis - Purchase Procedure and Stores Management - Marketing Management - Concept -Meaning-Nature-Functions		

of Marketing-Marketing Mix-Channels of Distribution-Advertisement and Sales Promotion-Marketing Strategies based on Product Life Cycle.

Module – III	Human Resources Management	10 Hrs

HRM - Definition and Meaning – Nature - Managerial and Operative functions - Evolution of HRM - Job Analysis - Human Resource Planning (HRP)- Employee Recruitment-Sources of Recruitment-Employee Selection -Process and Tests in Employee Selection –Employee Training and Development-On-the-job & Off-the-job training methods-Performance Appraisal Concept- Methods of Performance Appraisal – Placement- Employee Induction –Wage and Salary Administration.

Module – IV	Strategic Project Management	10 Hrs

Definition & Meaning-Setting of Vision -Mission -Goals –Corporate Planning Process-Environmental Scanning - Steps in Strategy Formulation and Implementation - SWOT Analysis –Project Management-Network Analysis-Program Evaluation and Review Technique (PERT) - Critical Path Method (CPM) Identifying Critical Path - Probability of Completing the project with in given time-Project Cost-Analysis-Project Crashing (Simple problems).

Module – V	Contemporary Issues in Management	8 Hrs

The concept of Management Information System (MIS)-Materials Requirement Planning (MRP)-Customer Relations Management (CRM)-Total Quality Management (TQM) –Six Sigma Concept-Supply Chain Management (SCM)-Enterprise Resource Planning (ERP)-Performance Management-Business Process Outsourcing (BPO)-Business Process Re-engineering and Bench Marking-Balanced Score Card-Knowledge Management.

Text Books:
1. A. R. Aryasri, "Management Science", TMH,2 013
2. Stoner, Freeman and Gilbert, "Management", Pearson Education, New Delhi,2012.

Reference Books:
1. Koontz & Weihrich, "Essentials of Management", 6th edition, TMH, 2005.
2. Thomas N.Duening & John M.Ivancevich, "Management Principles and Guidelines", Biztantra.
3. Kanishka Bedi, "Production and Operations Management", Oxford University Press, 2004.
4. Samuel C.Certo, "Modern Management",9th edition, PHI, 2005

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ENTREPRENEURSHIP AND INNOVATION
(Common to CSE, AI&ML, DS, CS, CE)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0024T	3:0:0:0	3	CIE:30 SEE:70	3 Hours	HSC

Course Objectives:

This course will enable students to:
- Make the student understand about Entrepreneurship
- Know various sources of generating new ideas in setting up of new enterprise
- Know various sources of finance in starting up of a business
- Impart knowledge about various government sources which provide financial assistance to entrepreneurs / women entrepreneurs
- Encourage the student in creating and designing business plans

Course Outcomes (CO):

On completion of this course, student will be able to
- Understand the concept of Entrepreneurship and challenges in the world of competition(L2)
- Apply the Knowledge in generating ideas for New Ventures(L3)
- Analyze various sources of finance and subsidies to entrepreneur / women Entrepreneurs(L4)
- Evaluate the role of central government and state government in promoting entrepreneurship(L3)
- Create and design business plan structure through incubations(L3)

Syllabus		Total Hours:48
Module – I	Entrepreneurship	10 Hrs
Entrepreneurship-Concept, knowledge and skills requirement-Characteristics of successful entrepreneurs-Entrepreneurship Process-Factors impacting emergence of entrepreneurship-Differences between Entrepreneur and Intrapreneur-Understanding individual entrepreneurial mind set and personality-Recent trends in Entrepreneurship.		
Module – II	Starting Up New Venture	10 Hrs
Starting the New Venture - Generating business idea – Sources of new ideas & methods of generating ideas-Opportunity Recognition-Feasibility Study-Market feasibility, technical / operational feasibility - Financial feasibility - Drawing business plan - Preparing project report – Presenting business plan to investors.		
Module – III	Sources of Finance	10 Hrs
Sources of finance - Various sources of Finance available - Long term sources - Short term sources - Institutional Finance – Commercial Banks, SFC's in India- NBFC's in India - theirway of financingin India for small and medium business -Entrepreneurship development programs in India – The entrepreneurial journey- Institutions in aid of entrepreneurship development		
Module – IV	Women Entrepreneurship	10 Hrs

Women Entrepreneurship-Entrepreneurship Development and Government-Role of Central Government and State Government in promoting women Entrepreneurship - Introduction to various incentives, subsidies and grants – Export- oriented Units - Fiscal and Tax concessions available - Women entrepreneurship - Role and importance - Growth of women entrepreneurship in India-Issues & Challenges-Entrepreneurial motivations.

Module – V	**Introduction to Incubation & Innovation**	**8 Hrs**

Fundamentals of Business Incubation - Principles and good practices of business incubation- Process of business incubation – Types, Advantages and Disadvantages of incubation.

Innovation Meaning & Definition - Forms of innovation - Innovation, features and characteristics - Factors initiating innovations - Innovation process and its stages.

Text Books:
1. D F Kuratko and T V Rao, "Entrepreneurship"- A South-Asian Perspective–Cengage Learning, 2012. (For PPT,Case Solutions Faculty may visit: login.cengage.com)
2. Nandan H, "Fundamentals of Entrepreneurship", PHI, 2013

Reference Books:
1. Vasant Desai, "Small Scale Industries and Entrepreneurship", Himalaya Publishing 2012.
2. Rajeev Roy "Entrepreneurship", 2nd Edition, Oxford, 2012.
3. B.Janakiram and M.Rizwana ‖ "Entrepreneurship Development: Text & Cases", Excel Books, 2011.
4. Stuart Read, Effectual "Entrepreneurship", Routledge, 2013.

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BUSINESS ENVIRONMENT

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

Course Code	L: T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0025T	3:0:0:0	3	CIE:30 SEE:70	3 Hours	HSC

Course Objectives:

This course will enable students to:

- Understand about the business environment.
- Know the importance of fiscal and monitory policy.
- Understand the export policy of the country.
- Impart knowledge about the functioning and role of WTO.
- know the structure of stock market.

Course Outcomes (CO):

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

- Understand various types of business environment(L2)
- Understand fiscal and monitory policy(L2)
- Analyze India's Trade Policy(L4)
- Understand the role of WTO(L2)
- Apply the knowledge of Money markets in future investment(L3)

Syllabus		Total Hours:48
Module – I	An Overview of Business Environment	10 Hrs

Overview of Business Environment – Types of Environments - Internal & External –Micro and Macro environment- Competitive structure of industries - Environmental analysis -   Scope of business-Characteristics of business-Process & limitations of environmental analysis.

Module – II	Fiscal Policy & Monetary Policy	10 Hrs

FISCAL POLICY-Public Revenues-Public Expenditure-Public debt Development activities financed by public expenditure - Evaluation of recent fiscal policy of Government of India - Highlights of Budget - MONETARY POLICY - Demand and Supply of Money – RBI –Objectives of monetary and credit policy-Recent trends-Role of Finance Commission.

Module – III	India's Trade Policy & Balance of Payments	10 Hrs

INDIA'S TRADE POLICY - Magnitude and direction of Indian International Trade – Bilateral and Multilateral Trade Agreements - EXIM policy and role of EXIM bank - BALANCE OF PAYMENTS– Structure & Major Components-Causes for Disequilibrium in Balance of Payments-Correction

measures–WTO - Nature and Scope - Organization and Structure – Role and functions of WTO in promoting world trade

Module – IV	Money Markets and Capital Markets	10 Hrs

Features and components of Indian financial systems - Objectives, features and structure of money markets and capital markets -Reforms and recent development– SEBI - Stock Exchanges - Investor protection and role of SEBI.

Module – V	Introduction To Inflation	8 Hrs

Inflation – Meaning & Definition – Causes – Effects – Types – Advantages & Disadvantages Deflation – Meaning & Definition - Causes & Effects.

Text Books:
1. Francis Cherunilam (2009), "International Business": Text and Cases, Prentice Hall of India.
2. K.Aswathappa, "Essentials of Business Environment": Texts and Cases & Exercises 13th Revised Edition. HPH 2016.

Reference Books:
1. K.V.Sivayya,V.B.MDas (2009), Indian Industrial Economy, Sultan Chand Publishers, New Delhi, India.
2. Sundaram, Black (2009), International Business Environment Text and Cases, Prentice Hall of India, New Delhi, India.
3. Chari.S.N (2009), International Business, Wiley India.
4. E.Bhattacharya (2009), International Business, Excel Publications, New Delhi.

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SOFTWARE PROJECT MANAGEMENT					
(Common to CSE, AI&ML, DS, CS)					
Course Code	**L: T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0534Ta	**3:0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**PEC**

Course Objectives:

This course will enable students to:

- Understand the specific roles within a software organization as related to Project and process management.
- Study the improving software processes and the principles of conventional software engineering.
- Learn the Software Life Cycle Phases and Artifact.
- Understand the Iterative Process Planning and Process Automation.
- Learn the basic steps of project planning, project management, quality assurance, and process management and their relationships.

Course Outcomes (CO):

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

- Describe the purpose of project management from the perspectives of planning, tracking and completion of project(L2)
- Determine the conventional software Management and Software Economics(L2)
- Use the improving software processes and modern software management(L3)
- Use the software Life Cycle Phases and artifact sets(L3)
- Determine the Iterative Process Planning and Process Automation(L3)
- Apply the quality indicators and Core Metrics(L3)

Syllabus		**Total Hours:50**
Module-I	**Conventional Software Management**	**10 Hrs**

The waterfall model, conventional software Management performance. Evolution of Software Economics: Software Economics, pragmatic software cost estimation.

Module-II	**Improving Software Economics**	**8 Hrs**

Reducing Software product size, improving software processes, improving team effectiveness, Improving automation, Achieving required quality, peer inspections.

The old way and the new: The principles of conventional software engineering, principles of modern software management.

Module-III	**Life Cycle Phases and Artifacts of the Process**	**10Hrs**

Engineering and production stages, inception, Elaboration, construction, transition phases. The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts. Model based software architectures: A Management perspective and technical perspective.

Module-IV	Work Flows of the Process, Project Organizations and Responsibilities	10 Hrs

Checkpoints of the Process, Iterative Process Planning, Line-of-Business Organizations, Project Organizations.
Process Automation: Tools, The Project Environment.

Module-V	Project Control and Process Instrumentation	10 Hrs

The seven core Metrics, Management indicators, quality indicators, life cycle expectations pragmatic Software Metrics, Metrics automation. Tailoring the Process: Process discriminates.
The Command Center Processing and Display System-Replacement (CCPDS-R), Process overview, Core Metrics.

Text Books:
1. Walker Royce," Software Project Management", Pearson Education.
2. Bob Hughes & Mike Cotterell, "Software Project Management", fourth edition, Tata McGraw Hill.

Reference Books:
1. Andrew Stellman & Jennifer Greene, "Applied Software Project Management", O"Reilly, 2006
2. Jennifer Greene & Andrew Stellman, "Head First PMP", O"Reilly,2007
3. Richard H. Thayer & Edward Yourdon, "Software Engineering Project Management", second edition, Wiley India, 2004.
4. Jim Highsmith, "Agile Project Management", Pearson education, 2004
5. Scott Berkun, "The art of Project management", O"Reilly, 2005.
6. Pankaj Jalote, "Software Project Management in Practice", Pearson Education, 2002.

E-resources:
1. https://archive.nptel.ac.in/courses/106/105/106105218/
2.

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SOCIAL NETWORK ANALYSIS

Course Code	L: T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A3311Tb	3:0:0:0	3	CIE: 30 SEE:70	3Hours	PEC

Course Objectives:

This course will enable students to:

- Understand the basic concepts of social network analysis
- Identify communities in social networks
- Perform predictive analytics in social networks

Course Outcomes (CO):

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

- Understand the basic concepts of Social Networks(L2)
- Compute different centrality measures of social network(L3)
- Detect communities in social networks(L3)
- Predict links in social networks(L3)
- Perform Social Influence Analysis(L3)

Syllabus		Total Hours:48
Module-I	**Fundamentals of Networks**	**10 Hrs**

Networks in the real world: Social networks, Information networks, Technological networks, biological networks
Mathematics of networks: Networks and their representation, Types of networks: Weighted, directed and hyper graphs, the adjacency, Laplacian, and incidence matrices, Degree, paths, components, independent paths, connectivity, and cut sets.

Module-II	**Centrality measures**	**9 Hrs**

Degree centrality, Closeness centrality, Homophily, Transitivity and Preferential attachment, Clustering coefficient and Assortative mixing, Eigenvector centrality, Katz centrality, Betweenness centrality, Page rank, Hubs and Authorities

Module-III	**Community Detection in Social Networks**	**10 Hrs**

Detecting communities in social networks, Definition of community, Applications of community detection. Algorithms for community detection: The Kernighan-Lin Algorithm, Agglomerative/Divisive Algorithms, Markov Clustering, Multi-level Graph Partitioning, Spectral Algorithms, Modularity Maximization, Other Approaches, Evaluating communities

Module-IV	**Predictive Analytics in Social Networks**	**10 Hrs**

Link prediction problem, Link prediction measures, Feature based Link Prediction, Evaluation Node classification problem Node classification: Problem definition and applications; Iterative classification methods; Label propagation method; Graph regularization method; Evaluation

Module-V	**Current Research in Social Networks**	**9 Hrs**

Social Influence Analysis, privacy in social networks, integrating sensors and social networks, multimedia information networks in social media and social tagging and applications.

Text Book:
1. Newman, M. E. J. (2010), "Networks: An introduction. "Oxford University Press.
2. Alexander Kouznetsov, "Social Network Analysis for Start-ups: Finding connections on the social web**",** Shroff publishers and distributors Pvt. Ltd

Reference Books:
1. Tanmay Chakraborty "Social Network analysis" Wiley
2. Newman, M. E. J. (2010). Networks: an introduction. Oxford; New York: Oxford University Press.
3. Aggarwal, C. C. (2011). An introduction to social network data analytics. In Social network data analytics (pp. 1-15). Springer, Boston, MA.
4. Barabási, A. L. (2013). Network science. Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences, 371(1987), 20120375.

Web References:

https://social-network-analysis.in/

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INTERNET OF THINGS

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

Course Code	L: T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0534Tc	3:0:0:0	3	CIE:30 SEE:70	3 Hours	PEC

Course Objectives:

This course will enable students to:

- Understand the terminology of IOT, technology and its applications
- Understand the concept of M2M (machine to machine) with necessary protocols
- Understand the Python Scripting Language which is used in many IoT devices
- Understand the Raspberry PI platform, that is widely used in IoT applications
- Understand the implementation of web based services on IoT devices

Course Outcomes (CO):

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

- Interpret the impact and challenges posed by IoT networks leading to new architectural models(L2)
- Compare and contrast the deployment of smart objects and the technologies to connect themto network(L4)
- Appraise the role of IoT protocols for efficient network communication(L2)
- Elaborate the need for Data Analytics and Security in IoT(L2)
- Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry(L2)

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

Introduction to Internet of Things –Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT communication models, IoT Communication APIs IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates Domain Specific IoTs – Home, City, Environment, Energy, Retail,Logistics, Agriculture, Industry, health and Lifestyle

Module-II IoT and M2M	**8 Hrs**

IoT and M2M – Software defined networks, network function virtualization, difference between SDN and NFV for IoT Basics of IoT System Management with NETCOZF, YANG- NETCONF, YANG, SNMP NETOPEER

Module-III Introduction to Python	**10Hrs**

Introduction to Python - Language features of Python, Data types, data structures, Control of flow, functions, modules, packaging, file handling, data/time operations, classes, Exception handling Python packages - JSON, XML, HTTPLib, URLLib, SMTPLib

Module-IV	IoT Physical Devices and Endpoints	10 Hrs

IoT Physical Devices and Endpoints - Introduction to Raspberry PI-Interfaces (serial, SPI, I2C) Programming – Python program with Raspberry PI with focus of interfacing external gadgets, controlling output, and reading input from pins

Module-V	IoT Physical Servers and Cloud Offerings	10 Hrs

IoT Physical Servers and Cloud Offerings – Introduction to Cloud Storage models and communication APIs Web server – Web server for IoT, Cloud for IoT, Python web application framework designing a Restful web API

Text Books:

1. Arshdeep Bahga and Vijay Madisetti, "Internet of Things - A Hands-on Approach", UniversitiesPress, 2015.
2. Matt Richardson & Shawn Wallace, "Getting Started with Raspberry" PiO'Reilly (SPD), 2014

Reference Books:
1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos,David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a NewAge of Intelligence", 1st Edition, Academic Press, 2014.
2. Pethuru Raj,Anupama C. Raman, "The Internet of Things, Enabling technologies and use cases" CRC Press.

Web References
1. https://www.arduino.cc/
2. https://www.raspberrypi.org/

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

Course Code	L: T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A3312Td	3:0:0:0	3	CIE: 30 SEE:70	3 Hours	PEC

Course Objectives:

This course will enable students to:

- Extend the students' knowledge of fog computing & edge computing
- Enhance their expertise in area of wearable computing enjoinment
- Carry out real life application of fog computing.

Course Outcomes (CO):

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

- Understand the basic concepts of Fog Computing(L2)
- Understand the architecture and Components of Fog Computing System(L2)
- Understand different Fog Protocols(L2)
- Understand the Security Methods of Fog computing system(L2)
- Understand the applications of Fog Computing(L2)

Syllabus		Total Hours:50
Module-I	**Introduction to Fog Computing**	**10 Hrs**
Introduction to Fog Computing: Fog Computing-Definition-Characteristics-Application Scenarios -Issues –Fog. Computing and Internet of Things-Pros and Cons-Myths of Fog Computing -Need and Reasons for Fog Computing Fog Computing and Edge Computing-IoT,FOG, Cloud Benefits.		
Module-II	**Architecture**	**8 Hrs**
Architecture: Working Procedure -Performance Evaluation Components- Software Systems – Architecture-Modeling and Simulation –Challenges.		
Module-III	**Fog Protocols**	**10Hrs**
Fog Protocols: Fog Protocol-Fog Kit- Proximity Detection Protocols- DDS/RTPS computing protocols.		
Module-IV	**Management of Data and Security Analysis:**	**10 Hrs**
Management of Data and Security Analysis: Smart Management of Big Data-Smart Data-Structure of Smart Data- Smart Data Life. Cycle-System Architecture-Multi-dimensional Payment Plan Security and Privacy. Issues-Multimedia Fog Computing-Architecture-Deduplication-Hybrid Secure. Deduplication- Security Challenges-Security Requirements		
Module-V	**Applications of Fog Computing**	**12 Hrs**
CASE STUDY: Case Study: Wind Farm - Smart Traffic Light System, Wearable Sensing. Devices, Wearable Event Device, Wearable System, Demonstrations		

Text Books:

Assad Abbas, Samee U. Khan "Fog Computing: Theory and Practice " wiley India May2020.

Reference Books:

1.Jennifer Greene & Andrew Stellman, Stojan Kitanov , "Introduction to Fog Computing" IGI Global Publication.Head First PMP, O"Reilly,2007

2.Ivan Stojmenovic, Sheng Wen ," The Fog Computing Paradigm: Scenarios and Security Issues" Proceedings of the 2014 Federated Conference on Computer Science and Information Systems pp. 1–8

3.Amir Vahid Dastjerdi and Rajkumar Buyya "Fog Computing: Helping the Internet of Things Realize its Potential

Web References:

https://archive.nptel.ac.in/courses/106/105/106105218/

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Speech Recognition and Synthesis (Common to CSE, AI&ML, DS, CS)					
Course Code	**L: T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A3313T	3:0:0:0	3	CIE: 30 SEE:70	3 Hours	PEC

Course Objectives:

This course will enable students to:
- Understand the concepts of Speech Recognition and synthesis
- Understand different methods of feature extraction from speech
- Implement different speech recognition algorithms

Course Outcomes (CO):

On completion of this course, the students will be able to
- Understand the concepts of speech and signal Processing(L2)
- Implement edge detection algorithms and feature extraction methods such as MFCCs for speech recognition tasks(L3)
- Utilize the Baum-Welch algorithm to estimate HMM parameters from observed data(L3)
- Evaluate the effectiveness of LVCSR systems in real-world applications(L3)
- Implement a basic TTS system using sub word units(L3)
- Execute procedures for TTS waveform generation(L3)

Syllabus		Total Hours:48
Module-I	**Speech Fundamentals**	**9 Hrs**
Basic Concepts: Articulatory Phonetics – Production and Classification of Speech Sounds; Acoustic Phonetics – acoustics of speech production; Review of Digital Signal Processing concepts; Short-Time Fourier Transform, Filter-Bank and LPC Methods.		
Module-II	**Speech Analysis**	**10 Hrs**
Features, Feature Extraction and Pattern Comparison Techniques: Speech distortion measures – mathematical and perceptual – Log Spectral Distance, Cepstral Distances, Weighted Cepstral Distances and Filtering, Likelihood Distortions, Spectral Distortion using a Warped Frequency Scale, LPC, PLP and MFCC Coefficients, Time Alignment and Normalization – Dynamic Time Warping, Multiple Time – Alignment Paths		
Module-III	**Speech Modeling**	**10 Hrs**

Hidden Markov Models: Markov Processes, HMMs – Evaluation, Optimal State Sequence – Viterbi Search, Baum-Welch Parameter Re-estimation, Implementation issues

Module-IV	Speech Recognition	10Hrs

Large Vocabulary Continuous Speech Recognition: Architecture of A Large Vocabulary Continuous Speech Recognition System – Acoustics and Language Models – N grams, Context Dependent Sub-Word Units; Applications and Present Status.

Module-V	Speech Synthesis	9 Hrs

Text-to-Speech Synthesis: Concatenative and Waveform Synthesis MethodsSub word Units for TTS, Intelligibility and Naturalness – Role of Prosody, Applications and Present Status.

Text Books:

1. Lawrence Rabiner and Biing-Hwang Juang, "Fundamentals of Speech Recognition", Pearson Education, 2003.

Reference Books:

1. Daniel Jurafsky and James H Martin, "Speech and Language Processing – An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Pearson Education.

2. .Steven W. Smith, "The Scientist and Engineer's Guide to Digital Signal Processing", California Technical Publishing.

3. Thomas F Quatieri, "Discrete-Time Speech Signal Processing – Principles and Practice", Pearson Education.

Web References:

https://nptel.ac.in/courses/112105293

https://archive.nptel.ac.in/courses/112/105/112105293/

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

Course Code	L: T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A3314Tb	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.
- Be familiarize with Python libraries for Data Visualization.
- Elucidate various Machine Learning algorithms

Course Outcomes (CO):

On completion of this course, student will be able to
- Understand the basic concepts of Data Science. (L2)
- Learn about types of data and data preprocessing(L2)
- Visualize the data using NumPy, Pandas and Matplotlib(L3)
- Solve decision making problems using k-NN, Naïve Bayes, SVM and Decision(L3)
- Demonstrate the way to use machine Learning algorithms using python(L3)

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

Introduction: What Is Data Science? How Does Data Science Relate to Other Fields? Data Science and Statistics, Computer Science, Engineering and Business Analytics.
Data Science, Social Science, and Computational Social Science, The Relationship between Data Science and Information Science, Information vs. Data, Skills for Data Science, Tools for Data Science.

Module-II	**Types of Data**	**9 Hrs**

Data: Introduction, Data Types, Structured Data, Unstructured Data, Challenges with Unstructured Data, Data Collections, Open Data, Social Media Data, Multimodal Data, Data Storage and Presentation.

Module-III	**Techniques and Introduction to Libraries**	**10 Hrs**

Data: Data Pre-processing, Data Cleaning, Data Integration, Data Transformation, Data Reduction, Data Discretization.
Introduction to NumPy, Pandas, Matplotlib, Exploratory Data Analysis (EDA), Descriptive Statistics, Basic tools (plots, graphs and summary statistics) of EDA.

Module-IV	**Machine Learning for Data Science-1**	**10 Hrs**

Machine Learning for Data Science-1: Supervised machine learning algorithms: what is regression, simple linear regression, multiple regression and Logistic regression, classification algorithms: k-Nearest Neighbors, Naive Bayes, SVM

Module-V	Machine Learning for Data Science-2	9 Hrs

Machine Learning for data Science-2: Unsupervised learning algorisms overview: what is clustering, types of clustering algorithms, hierarchical clustering, k means clustering, what is Association, Differences between supervised and un supervised learning algorithms

Text Books:
1. Chirag Shah, "A Hands-On Introduction to Data Science", Cambridge University Press.
2. Allen B. Downey, "Think Python", 2nd edition, SPD/O'Reilly, 2016.
3. Joel Grus, "Data Science from Scratch, First Principles with Python" O'Reilly, First Edition.

Reference Books:
1. Field Cady ,"The Data Science Handbook" , WILEY.
2. Jeffrey M. Stanton, Jeffrey Stanton, "An Introduction to Data Science", 2012
3. Cathy O'Neil, Rachel Schutt, "Doing Data Science", Straight Talk from the Frontline. O'Reilly,2013.
4. Christopher Bishop, "Pattern Recognition and Machine Learning", Springer, 2007
5. Dr. Gypsy Nandi, Dr. Rupa Kumar Sharma. "Data Science Fundamentals and Practical Approaches".

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ADHOC AND WIRELESS SENSOR NETWORKS					
(Common to AI&ML, DS, CS)					
Course Code	**L: T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0535Tc	**3:0:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**PEC**

Course Objectives:

This course will enable students to:

- Understand the state-of-the-art research in the emerging subject of Adhoc and Wireless Sensor Networks
- Solve the issues in real-time application development based on ASN.
- Conduct further research in the domain of ASN

Course Outcomes (CO):

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

- Understand the concepts of Wireless Sensor Networks(L2)
- Understand the data transmission in Wireless Adhoc Networks(L2)
- Understand the protocols of Wireless Sensor Networks(L2)
- Understand the layered architecture of Adhoc networks(L2)

Syllabus		Total Hours:48
Module-I	**Introduction to Adhoc Networks**	**9 Hrs**

Introduction to Ad Hoc Networks - Characteristics of MANETs, Applications of MANETs and Challenges of MANETs.

Routing in MANETs - Criteria for classification, Taxonomy of MANET routing algorithms, Topology- based routing algorithms-**Proactive**: DSDV; **Reactive**: DSR, AODV; Hybrid: ZRP; Position-based routing algorithms-**Location Services**-DREAM, Quorum-based; **Forwarding Strategies:** Greedy Packet, Restricted Directional Flooding-DREAM, LAR.

Module-II	**Data Transmission**	**10 Hrs**

Data Transmission - Broadcast Storm Problem, **Rebroadcasting Schemes**-Simple-flooding, Probability-based Methods, Area-based Methods, Neighbor Knowledge-based: SBA, Multipoint Relaying, AHBP. **Multicasting: Tree-based:** AMRIS, MAODV; **Mesh-based:** ODMRP, CAMP; **Hybrid:** AMRoute**,** MCEDAR.

Module-III	**Geo Casting**	**9 Hrs**

Geocasting: Data-transmission Oriented-LBM; Route Creation Oriented-GeoTORA, MGR**.** TCP over Ad Hoc TCP protocol overview, TCP and MANETs, Solutions for TCP over Ad hoc

Module-IV	**Lower Layers of Sensor Networks**	**10Hrs**

Basics of Wireless, Sensors and Lower Layer Issues: Applications, Classification of sensor networks, Architecture of sensor network, Physical layer, MAC layer, Link layer, Routing Layer.		
Module-V	**Upper Layers of Sensor Networks**	**10Hrs**

Upper Layer Issues of WSN: Transport layer, High-level application layer support, Adapting to the inherent dynamic nature of WSNs, Sensor Networks and mobile robots.

Text Books:

1. Carlos Corderio Dharma P. Aggarwal,"Ad Hoc and Sensor Networks – Theory and Applications", World Scientific Publications, March 2006.
2. Feng Zhao, LeonidasGuibas, "Wireless Sensor Networks: Information Processing Approach", Elsevier Science

Reference Books:

1. A.Grama, A. Gupta, G. Karypis and V. Kumar,"An Introduction to Parallel Computing: Design and Analysis of Algorithm"s, Second Edition - Pearson. Feng Zhao and Leonides Guibas, "Wireless Sensor Networks", Elsevier Publication - 2002.

2. Holger Karl and Andreas Willig "Protocols and Architectures for Wireless Sensor Networks", Wiley, 2005

Web References:

1. NPTEL: Computer Science and Engineering - NOC: Wireless Adhoc and Sensor Networks

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CLOUD SECURITY						
(Common to CSE, AI&ML, DS, CS)						
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**		**Course Type**
22A3315Td	**3:0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**		**PEC**

Course Objectives:

This course will enable students to:
- Impart fundamental concepts in the area of virtualization.
- Impart knowledge in infrastructure as a service.
- Explain monitoring, management and applications.
- Understand the concept of design patterns.
- Learn to design the trusted cloud computing system.

Course Outcomes (CO):

On completion of this course, student will be able to
- Use the fundamentals of virtualization(L3)
- Analyze the cloud service models(L4)
- Apply the cloud monitoring, management and applications(L3)
- Build a cloud security application(L3)
- Create a scenario for threat protection(L3).

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

Fundamentals: System Modeling, Clustering and Virtualization: distributed system models and enabling technologies, computer clusters for scalable parallel computing, virtual machines and virtualization of clusters and data centers. introduction to cloud computing, migrating into cloud, enriching the integration of service paradigm for cloud era, the enterprise cloud computing paradigm

Module-II	**Infra Structure as Service**	**9 Hrs**

Infra Structure as Service: Virtual machine provisioning and migration services, on the management of virtual machines for cloud infrastructure, enhancing cloud computing environments using a cluster as service, secure distributed data storage in cloud computing Aneka, comet cloud, T-systems, work flow engine for clouds, understanding scientific applications for cloud environments.

Module-III	**Cloud Data Security**	**10 Hrs**

Data Protection (rest, at transit, in use), Data Information lifecycle, Cloud Data Audit (Intro, Audit, Best Practice): Aws — EBS, S3, Azure — SAS, Demo-Aws cli & powershell & Amazon, Azure portal, Key management, Cloud Key management Audit (Intro, Audit, Best Practice): Aws —KMS, Azure — Azure Key Vault

Module-IV	Identity and Access Management	10 Hrs

Introduction to Identity and Access Management, Introduction to Federated Identity Management, Case Study, Cloud IAM Audit (Intro, Audit, Best Practice): Aws —IAM, Demo -Aws Cli & Amazon portal

Module-V	Cloud Application Security	9 Hrs

Cloud Application Challenges, OWSAP Top 10, Secure SDLC, Dev Sec Ops, Cloud Trail, Cloud watch, Lambda

Text Books:

1.Ronald L. Krutz, Russell Dean Vines, "Cloud Security: A Comprehensive Guide to Secure Cloud Computing", 30 July 2010

Reference Books:

1. Charlie Kaufman, "Network Security: Private Communication in a Public World", 2nd edition, Prentice Hall. A
tul Kahate 2008.
2. Robert Bragg, Mark Rhodes "Cryptography and Network Security", 2nd edition, Tata Mc Grawhill, India., 2004.

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LARGE LANGUAGE MODELS
(Common to CSE, AI&ML, DS, CS)

Course Code	L: T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A3316Ta	3:0:0:0	3	CIE: 30 SEE:70	3 Hours	PEC

Course Objectives:

This course will enable students to:
- Explore the fundamental Natural Language Processing
- Understand the basic concepts of Linguistic fundamentals for NLP.
- Be familiarize with Data Collection and Pre-processing for Language Modeling.
- Understand the Neural Networks in Language Modeling, Transformer-based Models for Language Modeling

Course Outcomes (CO):

On completion of this course, student will be able to
- Understand the basic concepts of Natural Language Processing(L2)
- Learn about Linguistic fundamentals for NLP(L2).
- Analyze Data Collection and Pre-processing for Language Modeling(L4)
- Apply Neural Networks in Language Modeling(L3)
- Apply Transformer-based Models for Language Modeling(L3)

Syllabus		Total Hours:48
Module-I	**Fundamentals of Natural Language Processing**	**10Hrs**

Introduction, Structure, Objectives, The definition and applications of NLP, The history and evolution of NLP, The components of NLP

Module-II	**Linguistic fundamentals for NLP**	**9 Hrs**

The challenges of NLP, Introduction to Language Models, A brief history of language models and their evolution, Types of language models, Autoregressive and auto encoding language models, Examples of large language models, Training basic language models

Module-III	**Data Collection and Pre-processing for Language Modeling**	**10 Hrs**

Introduction, Data acquisition strategies, Data cleaning techniques, Text pre-processing: preparing text for analysis, Data annotation, Managing noisy and unstructured data, Data privacy and security

Module-IV	**Neural Networks in Language Modeling**	**10 Hrs**

Introduction, Introduction to neural networks, Backpropagation, Gradient descent, Neural Network Architectures for Language Modeling, Understanding shallow and deep neural networks, Fundamentals of RNN, Types of RNNs:

Module-V	Transformer-based Models for Language Modeling	9 Hrs

Introduction, Key concepts, Transformer architecture, Advantages and limitations of transformers, Training Large Language Models, Building a tiny language model, Building a character-level text generation model Building effective LLMs

Text Books:

1.Sanket Subhash Khandare, "Mastering Large Language Models", BPB Publications

Reference Books:

1. Lior Gazit,Meysam Ghaffari ,"Mastering NLP from Foundations to LLMs", Packt Publishing
2. Gilbert Mizrahi ,"Unlocking the Secrets of Prompt Engineering", Packt Publishing

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BIG DATA TECHNOLOGIES
(Common to CSE, AI&ML, DS, CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0534Tb	3:0:0:0	3	CIE: 30 SEE:70	3 Hours	PEC

Course Objectives:

This course will enable students to:
- Understand the basic concepts and importance of Big Data
- Familiarize with the installation of Hadoop and how to analyze the Big Data
- Understand the design concepts of HDFS
- Provide good insight for developing a MapReduce applications
- Understand Hadoop environment.
- Explore the concepts of Pig, Hive, Spark and HBase

Course Outcomes (CO):

After the completion of the course students will able to
- Understand the concepts and tools of big data(L2)
- Analyzing the Data with Hadoop(L4)
- Develop MapReduce application(L3)
- Illustrate the Anatomy of MapReduce and Hadoop environment Determine why existing technologies are inadequate to analyze the large data(L2)
- Apply large-scale analytic tools to solve some of the open big data problems(L3)

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

Introduction to Big Data: Big data fundamentals, importance of big data, Structuring Big Data, Big Data Analytics, Meet Hadoop: Data, Data Storage and Analysis, History of Apache Hadoop, Hadoop Ecosystem, Installation of Hadoop, Analyzing the Data with Hadoop, Scaling Out.

Module-II	**HDFS and MapReduce**	**9Hrs**

HDFS: HDFS Concepts, HDFS Architecture, The Command-Line Interface, Data flow: Anatomy of a file read and Anatomy of a file write.
Map Reduce: Developing a Map Reduce application: The Configuration API, setting up the Development Environment, Running Locally on Test Data, Running on a Cluster.

Module-III	**How Map Reduce Works and Hadoop Environment**	**10Hrs**

How MapReduce Works: Anatomy of a Map Reduce Job Run, Failures, Shuffle and Sort.
Hadoop Environment: Setting up a Hadoop Cluster, Cluster specification, Cluster Setup and Installation, Hadoop Configuration.

Module-IV	**Data Analyzation using Pig as a tool**	**9Hrs**

Pig: Pig Concepts**,** Apache Pig Architecture, Installing and Running Pig, Comparison with Databases,

Pig Latin, User Defined Functions, Data Processing Operators.		
Module-V	**Open-Source tools for Big Data: Hive, Spark and HBase**	**10Hrs**

Hive: Hive concepts, Hive Architecture, Installing Hive, Comparison with traditional Databases, HiveQL, Tables, Querying Data.
Spark: Spark Concepts, Architecture of Spark, Installing Spark, Anatomy of a Spark Job Run.
HBase: Introduction to HBase, HBase Architecture, Installation.

Text Books:
1. Tom White, "Hadoop: The Definitive Guide"Fourth Edition, O'reilly Media, 2015.
2. "Big Data Black Book", DT Editorial services ,Dreamtech Press

Reference Books:
1. Michael Minnelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging business intelligence and analytic trends for today's businesses", Wiley Cio Series
2. Glenn J. Myatt, "Making Sense of Data" , John Wiley & Sons, 2007 Pete Warden,Big Data Glossary, O'Reilly, 2011.
3. Michael Berthold, David J.Hand," Intelligent Data Analysis", Spingers, 2007.
4. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos,"Uderstanding Big Data : Analytics for Enterprise Class Hadoop and Streaming Data", McGraw Hill Publishing, 2012.
5. Anand Rajaraman and Jeffrey David UIIman, "Mining of Massive Datasets", Cambridge University Press, 2012

Web References:

1. https://onlinecourses.swayam2.ac.in/arp19_ap60/preview
2. https://www.shiksha.com/online-courses/big-data-analytics-courses-certification-training-by-nptel-st601-tg91

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BLOCK CHAIN TECHNOLOGY (Common to CSE, AI&ML, DS, CS)					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0536Tc	**3:0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**PEC**

Course Objectives:

This course will enable students to:
- Illustrate the fundamental concepts of black chain.
- Determine the crypto currency primitives.
- Compare and contrast the bit coins and Crypto currency
- Illustrate the different security features

Course Outcomes (CO):

On completion of this course, student will be able to
- Describe the basic concepts and technology used for block chain(L2)
- Describe the primitives of the distributed computing and cryptography related to block chain(L2)
- Illustrate the concepts of Bit coin and their usage(L2)
- Implement Ethereum block chain contract(L3)
- Apply security features in block chain technologies(L3)
- Use smart contract in real world applications(L3)

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

Need for Distributed Record Keeping, Modeling faults and adversaries, Byzantine Generals problem, Consensus algorithms and their scalability problems, Nakamoto's concept with Block chain based crypto currency, Technologies Borrowed in Block chain – hash pointers, consensus, byzantine fault-tolerant distributed computing, digital cash etc

Module-II	**Basic Distributed Computing & Crypto primitives**	**10Hrs**

Atomic Broadcast, Consensus, Byzantine Models of fault tolerance, Hash functions, Puzzle friendly Hash, Collison resistant hash, digital signatures, public key crypto, verifiable random functions, Zero-knowledge systems

Module-III	**Bitcoin Basics**	**10Hrs**

Bitcoin blockchain, Challenges and solutions, proof of work, Proof of stake, alternatives to Bitcoin consensus, Bitcoin scripting language and their use

Module-IV	**Ethereum Basics**	**10Hrs**

Ethereum and Smart Contracts, The Turing Completeness of Smart Contract Languages and verification challenges, Using smart contracts to enforce legal contracts, comparing Bitcoin scripting vs. Ethereum Smart Contracts, Writing smart contracts using Solidity & JavaScript

Module-V	Privacy, Security issues in Block chain	9Hrs

Pseudo-anonymity vs. anonymity, Zcash and Zk-SNARKS for anonymity preservation, attacks on Block chains: Sybil attacks, selfish mining, 51% attacks advent of algorand; Sharding based consensus algorithms to prevent these attacks

Text Books:

1. Josh Thompson, 'Block chain: The Block chain for Beginnings, Guild to Block chain Technology and Block chain Programming', Create Space Independent Publishing Platform, 2017.
2. Narayanan, Bonneau, Felten, Miller and Goldfeder, "Bitcoin and Cryptocurrency Technologies – A Comprehensive Introduction", Princeton University Press.

Reference Books:

1. Imran Bashir, "Mastering Block chain: Distributed ledger technology, decentralization, and smart contracts explained", Packt Publishing.

2. Merunas Grincalaitis, "Mastering Ethereum: Implement Advanced Block chain Applications Using Ethereum-supported Tools, Services, and Protocols", Packet Publishing.

Web References:

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2. https://nptel.ac.in/courses/106104220

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HIGH PERFORMANCE COMPUTING					
(Common to CSE, AIML, CS& DS)					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A3317Td	**3:0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**PEC**

Course Objectives:

This course will enable students to:

- Learn concepts of parallel processing as it pertains to high-performance computing.
- Solve problems a raised in Parallel Processing.
- Design and analyze parallel programs on high performance computing resources using parallel programming paradigms

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand the basic concepts of Parallel Processing(L2)
- Understand the concept of Message Passing Programming(L2)
- Understand the concept of Pipelined computations(L2)
- Understand the concept of Load Balancing(L2)
- Understand the concept of Shared Memory Multiprocessors(L2)

Syllabus		Total Hours:48
Module-I	**Parallel Computers**	**9Hrs**
The Demand for Computational Speed, Potential for Increased Computational Speed, Types of Parallel Computers, Cluster Computing		
Module-II	**Message Passing Computing**	**9Hrs**
Basics of Message - Passing Programming, Using a Cluster of Computers, Evaluating Parallel Programs, Debugging and Evaluating Parallel Programs Empirically		
Module-III	**Pipelined Computations and Synchronous Computations**	**10Hrs**
Pipeline Technique, Computing Platform for Pipelined Applications, Pipeline Program Examples, Synchronization, Synchronization Computations, Synchronous Iteration Program Examples		
Module-IV	**Load Balancing and Termination Detection**	**10Hrs**
Load Balancing, Dynamic Load Balancing, Distributed Termination Detection Algorithms, Program Example		
Module-V	**Programming with Shared Memory**	**10Hrs**
Shared Memory Multiprocessors, Constructs for Specify Parallelism, Sharing Data, Parallel Programming Languages and Constructs, Performance Issues		

Text Books:
1. Parallel Programming: Techniques and Applications using Networked Work-stations and Parallel Computers" (2nd ed.) by B. Wilkinson and M. Allen, Prentice Hall..

Reference Books:
1. An Introduction to Parallel Computing: Design and Analysis of Algorithms, Second Edition - A.Grama, A. Gupta, G. Karypis and V. Kumar, Pearson.

Web References:

1. https://nptel.ac.in/courses/112105293

2. https://archive.nptel.ac.in/courses/112/105/112105293/

SMART GRID
(Open Elective-III)
(Common to CSE, AI&ML, CS, DS, ECE, EEE, ME)

Course Code	L: T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0241Ta	**3:0:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**OEC**

Course Objectives:

This course will enable students to gain knowledge on:
- Overview of the technologies required for the smart grid
- Switching techniques and different means for data communication
- Standards for information exchange and smart metering
- Methods used for information security on smart grid
- Smart metering and protocols for smart metering
- Power quality management with upgraded technologies.

Course Outcomes (CO):

On completion of this course, the students will be able to
- Understand the concepts and design of Smart grid(L2)
- Understand the various communication technologies in smart grid(L2)
- Understand the various measurement technologies in smart grid(L2)
- Understand the analysis and stability of smart grid(L2)
- Learn the renewable energy resources and storages integrated with smart grid(L2)
- Familiarize the high-performance computing for Smart Grid applications(L2)

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

Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers, functions, opportunities, challenges and benefits, Difference between conventional & Smart Grid, Concept of Resilient &Self-Healing Grid, Present development & International policies in Smart Grid, Diverse perspectives from experts and global Smart Grid initiatives

Module-II **Smart Grid Technologies**	**8 Hrs**

Technology Drivers, Smart energy resources, Smart substations, Substation Automation, Feeder Automation, Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and control, Distribution systems: DMS, Volt/VAR control, Fault Detection, Isolation and service restoration, Outage management, High Efficiency Distribution Transformers, Phase Shifting Transformers, Plug in Hybrid Electric Vehicles (PHEV).

Module–III **Smart Meters**	**10 Hrs**

Introduction to Smart Meters, Advanced Metering infrastructure (AMI) drivers and benefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement Unit (PMU), Intelligent Electronic Devices (IED) & their application for monitoring & protection.

Module-IV	Power Quality Management in Smart Grid	10 Hrs

Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.

Module–V	High Performance Computing	10 Hrs

Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN), Broadband over Power line (BPL), IP based Protocols, Basics of Web Service and CLOUD Computing to make Smart Grids smarter, Cyber Security for Smart Grid.

Textbooks:
1. Janaka Ekanayake, Liyanage, Wu, Akihiko Yokoyama, Jenkins, "Smart Grid", Wiley Publications, 2012, Reprint 2015.
2. James Momoh, "Smart Grid: Fundamentals of Design and Analysis", Wiley, IEEE Press., 2012, Reprint 2016.

Reference Books:

1. Clark W. Gellings," The Smart Grid – Enabling Energy efficiency and demand response", P.E., CRC Press, Taylor & Francis group, First Indian Reprint. 2015.
2. Lars Torsten Berger, Krzysztof Wisniewski," Smart Grid – Applications, Communications, and Security", WILEY, 2012, Reprint 2015.
3. Cobus Strauss, "Practical Electrical Network Automation and Communication Systems", ELSVIER, 2003

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BASIC VLSI DESIGN					
(Common **to CSE, AI&ML, CS, DS, ECE, EEE, ME**)					
Course Code	**L: T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0432T	**3:0:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**OEC**

Course Objectives:

This course will enable students to
- Gain exposure to different steps involved in fabrication Process of PMOS & NMOS transistors, CMOS & BICOM Inverters.
- Gain knowledge on electrical properties of MOS & BICMOS devices to analyze the behavior of inverters designed with various loads.
- Gain knowledge on Basic Circuit Concepts of VLSI Design
- Apply the design Rules and draw layout of a given logic circuit and basic circuit concepts to MOS circuits.
- Apply the design for testability methods for combinational & sequential CMOS circuits

Course Outcomes:

After the completion of the course students will able to:
- Acquire qualitative knowledge about the fabrication process of integrated circuit using MOS transistors(L2)
- Understand the concept of Basic Electrical Properties of MOS/Bi-CMOS Devices(L2)
- Apply the basic circuit concepts to MOS circuits(L3)
- Understand the concept of Scaling of MOS circuits and Limitations of Scaling(L2)
- Apply the design Rules to draw the Stick diagram &layout of a given logic circuit(L3)
- Interpret the need for testability and testing methods in VLSI(L2)

Syllabus		Total Hours: 48
Module–I	**Introduction to Fabrication Process**	**10 Hrs**

Introduction: Brief Introduction to IC technology, Moore's Law, Different modes MOSFET operation, Fabrication Process of PMOS, NMOS, CMOS & Bi-CMOS devices, Comparison between CMOS and Bi-polar Technologies.
Fabrication Steps: Wafer Preparation, Oxidation, Photolithography, Etching, Ion Implantations, Metallization, Testing.

Module– II	**Basic Electrical Properties of MOS/BiCMOS devices**	**10 Hrs**

Basic Electrical Properties: Ids Vs Vds relationships, MOS transistor Threshold Voltage-VT, figure of merit-ω0, Transconductance - gm, Output conductance-gds, Pass transistor logic, NMOS Inverter, Pull-up to Pull-down Ratio for NMOS inverter driven by another NMOS inverter, and through one or more pass transistors Various pull ups, CMOS Inverter analysis and design, Bi-CMOS Inverters.

Module– III	Basic Circuit Concepts	9 Hrs

Basic Circuit Concepts: Sheet Resistance Rs and concepts to MOS, Area Capacitances calculations, Inverter Delays, Driving large Capacitive Loads, Wiring Capacitances, Fan-in and fan-out

Module– IV	VLSI Circuit Design Processes	10 Hrs

VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, Lambda(λ)-based design rules for wires, contacts and Transistors, Layout Diagrams for NMOS and CMOS Inverters Logic Gates and Various MOS Circuits. Scaling of MOS circuits, Limitations of Scaling.

Module– V	CMOS Testing	9 Hrs

CAD Tools for Design and Simulation, Aspects of Design Tools, Design for Testability, Testing Combinational Logic, Testing Sequential Logic, Practical Design for Test (OFT) Guidelines, Scan Design Techniques, Built-In-Self-Test (BIST), Future Trends.

Text Books:

1. Kamran Eshraghian, "Essentials of VLSI Circuits and Systems", Douglas and A. Pucknell and SholehEshraghian, Prentice-Hall of India Private Limited, 2005 Edition.
2. Behzad Razavi , "Design of Analog CMOS Integrated Circuits", McGraw Hill, 2003

References Books:

1. Modern VLSI Design – Wayne Wolf, 3 Ed., 1997, Pearson Education.
2. Jan M. Rabaey, "Digital Integrated Circuits", AnanthaChandrakasan and Borivoje Nikolic, Prentice-Hall of India Pvt.Ltd, 2nd edition, 2009.
3. John P. Uyemura, "Introduction to VLSI Circuits and Systems", John Wiley & Sons, reprint 2009
4. CMOS VLSI Design-A Circuits and Systems Perspective, Neil H.E Weste, David Harris, Ayan Banerjee, 3rd Edn, Pearson, 2009.

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https://www.digimat.in/nptel/courses/video/108107129/L01.html

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DISASTER MANAGEMENT					
(Common **to CSE, AI&ML, CS, DS, ECE, EEE, ME**)					
Course Code	**L: T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0151T	**3:0:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**OEC**

Course Objectives:

This course will enable students to

- Develop an understanding of why and how the modern disaster manager is involved with pre-disaster and post-disaster activities.
- Develop an awareness of the chronological phases of natural disaster response and refugee relief operations
- Describe the three planning strategies useful in mitigation
- Describe public awareness and economic incentive possibilities
- Understand the tools of post-disaster management

Course Outcomes:

On completion of this course, student will be able to

- Know about the natural hazards and its management(L2)
- Know about the fire hazards and solid waste management(L2)
- Understand about the emerging infectious diseases and aids their management(L2)
- Know about the regulations of building codes and land use planning related to risk and vulnerability(L2)
- Impart the education related to risk reduction in schools and communities(L2)

Syllabus		**Total Hours: 48**
Module-I	**Natural Hazards and Disaster Management**	**9 Hrs**
Introduction of DM – Inter disciplinary -nature of the subject– Disaster Management cycle – Five priorities for action. Case study methods of the following: floods, draughts – Earthquakes – global warming, cyclones & Tsunamis – Post Tsunami hazards along the Indian coast – landslides		
Module-II	**Man Made Disaster**	**9 Hrs**
Fire hazards – transport hazard dynamics – solid waste management – post disaster – bio terrorism - threat in mega cities, rail and air craft's accidents, and Emerging infectious diseases & Aids and their management.		
Module–III	**Risk And Vulnerability**	**10 Hrs**

Building codes and land use planning – social vulnerability – environmental vulnerability – Macroeconomic management and sustainable development, climate change risk rendition – financial management of disaster – related losses.		
Module –IV	**Role of Technology in Disaster Management**	**10 Hrs**
Disaster management for infra structures, taxonomy of infra structure – treatment plants and process facilities-electrical substations roads and bridges- mitigation programme for earth quakes –flowchart, geospatial information in agriculture drought assessment-multimedia technology in disaster risk management and training- transformable indigenous knowledge in disaster reduction.		
Module–V	**Education and Community Preparedness**	**10 Hrs**
Education in disaster risk reduction-Essentials of school disaster education-Community capacity and disaster resilience-Community based disaster recovery -Community based disaster management and social capital-Designing resilience- building community capacity for action.		

Text Books:

1. Rajib shah & R R Krishnamurthy "Disaster Management" – Global Challenges and Local Solutions' Universities press. (2009),
2. Tushar Bhattacharya, "Disaster Science & Management" Tata McGraw Hill Education Pvt. Ltd., New Delhi

Reference Books:

1. Harsh. K. Gupta "Disaster Management edited", Universities press, 2003.

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1. https://www.youtube.com/watch?v=DExlZTfKZAM&list=PLC4PaTsQiLcbejXqJR7S59Ohk2OK1rgEG

MEASUREMENTS AND MECHATRONICS
(Common to CSE, AI&ML, CS, DS, ECE, EEE, ME)

Course Code	L: T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0327Tc	3:0:0:0	3	CIE:30 SEE:70	3 Hours	OEC

Course Objectives:

This course will enable students to
- Understand the principles of interchangeable manufacture.
- Understand basic principles of mechanical measurements.
- Impart knowledge on mechatronics systems.

Course Outcomes:

Upon successful completion of the course, the students will be able to
- Design the limit gauges for interchangeable manufacture(L3).
- Apply the basic principles of mechanical measurements for engineering practice(L3)
- Illustrate the role of mechatronics systems in manufacturing(L2)
- Explain principles of mechanical, hydraulic, pneumatic and electrical actuating systems(L2)

Syllabus		Total Hours: 48
Module-I	**Limits & Fits**	**10 Hrs**

Introduction, terminology pertaining to limits and fits – unilateral and bilateral tolerance system, hole and shaft basis systems – Interchangeability, deterministic & statistical tolerance, selective assembly. International Standard system of limits and fits

Limit Gauges: Taylor's principle – Classification and design of limit gauges.

Module-II	**Linear and Angular Measurements**	**10Hrs**

Line and end standards, slip gauges and length bars. bevel protractor – angle slip gauges – spirit levels and auto collimator.

Interferometry Applied to Measurement: NPL flatness interferometer and NPL gauge interferometer.

Surface Roughness Measurement: Differences between surface roughness and surface waviness- Numerical assessment of surface finish – CLA, R.M.S, Rz values, Methods of measurement of surface finish – Profilograph, Talysurf

Module-III	**Mechanical Measurements**	**10Hrs**

Introduction to measurement: Elements of generalized measurement system
Displacement Measurement- Linear Variable Differential Transformer (LVDT), encoders, potentiometers.

Temperature Measurement - Pyrometers, Resistance Temperature Detector (RTD) Strain Measurement-Electrical strain gauge – gauge factor – method of usage of resistance strain gauge		
Module-IV	**Mechatronics Systems**	**10 Hrs**
Mechatronics systems- Elements of mechatronics system, mechatronics design process, system - measurement systems, control systems, programmable logic controllers, case studies of mechatronic systems		
Module-V	**Actuating Systems**	**8Hrs**
Hydraulic and pneumatic actuating systems - fluid systems, hydraulic systems, and pneumatic systems, components, control valves. mechanical actuating systems and electrical actuating systems – basic principles and elements.		

Textbooks:

1. R.K. Jain, "Engineering Metrology", Khanna Publishers.
2. BeckWith, Marangoni, Linehard, " Mechanical Measurements", 6th edition,PHI / PE.

Reference Books:

1. W. Bolton , "Mechatronics – Electronic Control Systems in Mechanical and Electrical Engg.", 4th Edition, Pearson, 2012.
2. IC Guptha,"Engineering Metrology ",Danpath Rai Publications.
3. Doeblin Earnest. O. Adaptation by Manik and Dhanesh,"Measurement Systems: Application and Design", Tata Mc Graw Hill Publications.

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ELECTRIC VEHICLES					
(Open Elective-IV)					
(Common to all Except EEE)					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0232Ta	**3:0:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**OEC**

Course Objectives:

This course will enable students to

- Understand to Provide good foundation on hybrid and electrical vehicles.
- Understand To address the underlying concepts and methods behind power transmission in hybrid and electrical vehicles
- Familiarize energy storage systems for electrical and hybrid transportation
- Design and develop basic schemes of electric vehicles and hybrid electric vehicles.

Course Outcomes(CO):

On completion of this course, student will be able to

- Understand the working of hybrid and electric vehicles(L2)
- Apply a suitable drive scheme for developing an hybrid and electric vehicles depending on resources(L3)
- Develop the electric propulsion unit and its control for application of electric vehicles(L3)
- Understand the proper energy storage systems for vehicle applications(L2)
- Design and develop basic schemes of electric vehicles and hybrid electric vehicles(L3)

Syllabus		Total Hours:50
Module–I	**Electric Vehicle Propulsion and Energy Sources**	**10 Hrs**

Introduction to electric vehicles, vehicle mechanics - kinetics and dynamics, roadway fundamentals propulsion system design - force velocity characteristics, calculation of tractive power and energy required, electric vehicle power source - battery capacity, state of charge and discharge, specific energy, specific power, Ragone plot. battery modeling - run time battery model, first principle model, battery management system- soc measurement, battery cell balancing. Traction batteries - nickel metal hydride battery, Li-Ion, Lipolymer battery.

Module–II	**Electric Vehicle Power Plant and Drives**	**10Hrs**

Introduction electric vehicle power plants. Induction machines, permanent magnet machines, switch reluctance machines. Power electronic converters-DC/DC converters - buck boost converter, isolated DC/DC converter. Two quadrant chopper and switching modes. AC drives PWM, current control method. Switch reluctance machine drives - voltage control, current control.

Module–III	Hybrid And Electric Drive Trains	9Hrs

Introduction hybrid electric vehicles, history and social importance, impact of modern drive trains in energy supplies. Hybrid traction and electric traction. Hybrid and electric drive train topologies. Power flow control and energy efficiency analysis, configuration and control of DC motor drives and induction motor drives, permanent magnet motor drives, switch reluctance motor drives, drive system efficiency.

Module–IV	Electric and Hybrid Vehicles - Case Studies	9 Hrs

Parallel hybrid, series hybrid -charge sustaining, charge depleting. Hybrid vehicle case study – Toyota Prius, Honda Insight, Chevrolet Volt. 42 V system for traction applications. Lightly hybridized vehicles and low voltage systems. Electric vehicle case study - GM EV1, Nissan Leaf, Mitsubishi Miev. Hybrid electric heavy-duty vehicles, fuel cell heavy duty vehicles.

Module–V	Electric And Hybrid Vehicle Design	10Hrs

Introduction to hybrid vehicle design. Matching the electric machine and the internal combustion engine. Sizing of propulsion motor, power electronics, drive system. Selection of energy storage technology, communications, supporting subsystem. Energy management strategies in hybrid and electric vehicles - energy management strategies- classification, comparison, implementation.

Text Books:

1. Iqbal Hussein, "Electric and Hybrid Vehicles: Design Fundamentals", 2nd edition, CRC Press, 2003.
2. Amir Khajepour, M. Saber Fallah, AvestaGoodarzi, "Electric and Hybrid Vehicles: Technologies, Modeling and Control - A Mechatronic Approach", illustrated edition, John Wiley & Sons, 2014.

Reference Books:

1. Mehrdad Ehsani, YimiGao, Sebastian E. Gay, Ali Emadi, "Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design", CRC Press, 2004.
2. James Larminie, John Lowry, "Electric Vehicle Technology", Explained, Wiley, 2003.
3. John G. Hayes, G. Abas Goodarzi, "Electric Powertrain: Energy Systems, Power Electronics and Drives for Hybrid, Electric and Fuel Cell Vehicles", 1st edition, WileyBlackwell, 2018.

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INDUSTRIAL ELECTRONICS Common to (EEE, CSE, AI&ML, IT, CS, DS)					
Course Code	**L: T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0433T	**3:0:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**OEC**

Course Objectives:

This course will enable students to:
- Describe semi-conductor devices (such as PN junction diode & Transistor) and their switching characteristics.
- Understand the characteristics of AC to DC converters.
- Understand about the practical applications Electronics in industries.
- Describe the ultrasonic and its application.

Course Outcomes (CO):

On completion of this course, student will be able to
- Understand the semi-conductor devices and their switching characteristics(L2)
- Apply the Ultrasonic waves with different applications(L3)
- Understand the working of Transistor and its different configurations(L2)
- Analyze the thermal effects of ultrasonic, soldering and welding by ultrasonic, ultrasonic Drying in the industry; interpret the characteristics of AC to DC converters(L4)
- Develop the practical applications Electronics in industries(L3)
- Apply the process of Resistance welding, Induction heating and Dielectric heating in the industry(L3)

Syllabus		**Total Hours:48**
Module-I	**Scope of industrial Electronics**	**10 Hrs**
Scope of industrial Electronics, Semiconductors, Merits of semiconductors, crystalline structure, Intrinsic semiconductors, Extrinsic semiconductors, current flow in semiconductor, Open circuited p-n junction, Diode resistance, Zener diode, Photo conductors and junction photo diodes, Photo voltaic effect, Light emitting diodes (LED).		
Module-II	**Junction Transistor**	**9 Hrs**
Introduction, The junction transistor, Conventions for polarities of voltages and currents, Open circuited transistor, Transistor biased in the active region, Current components in transistors, Currents in a transistor, Emitter efficiency, Transport factor and transistor-α, Dynamic emitter resistance, Transistor as an amplifier, Transistor construction, Letter symbols for semiconductor Devices, Characteristic curves of junction transistor in common configuration, static characteristic curves of PNP junction transistor in common emitter configuration, The transistor in common collector Configuration.		
Module-III	**AC to DC converters**	**10 Hrs**

AC to DC converters- Introduction, Classification of Rectifiers, Half wave Rectifiers, Full wave Rectifiers, Comparison of Half wave and full wave rectifiers, Bridge Rectifiers, Bridge Rectifier meter, Voltage multiplying Rectifier circuits, Capacitor filter, LC Filter, Metal Rectifiers, Regulated Power Supplies, Classification of Voltage Regulators, Short period Accuracy of Regulators, Long period. Accuracy of Voltage Regulator, Principle of automatic voltage Regulator, Simple D.C. Voltage stabilizer using Zener diode, D.C. Voltage Regulators, Series Voltage Regulators, Complete series voltage regulator circuit, Simple series voltage regulator.

Module-IV	**Resistance welding controls**	**10 Hrs**

Resistance welding controls: Introduction, Resistance welding process, Basic Circuit for A.C. resistance welding, Types of Resistance welding, electronic welding control used in Resistance welding, Energy storage welding. Induction heating: Principle of induction heating, Theory of Induction heating merits of induction heating, Application of induction heating, High frequency power source of induction heating. Dielectric heating: Principle of dielectric heating, theory of dielectric heating, dielectric properties of typical materials, electrodes used in dielectric heating, method of coupling of electrodes to the R.F. generator, Thermal losses in Dielectric heating, Applications.

Module-V	**Ultrasonics**	**9 Hrs**

Ultrasonics: Introduction, Generation of Ultrasonic waves, Application of Ultrasonic waves, Ultrasonic stroboscope, ultrasonic as means of communication, ultrasonic flaw detection, Optical image on non-homogeneities, ultrasonic study of structure of matter, Dispersive study of structure of matter, Dispersive and colloidal effect of Ultrasonic, Coagulating action of Ultrasonic, separation of mixtures by ultrasonic waves, cutting and machining of hard materials by ultrasonic vibrations, Degassing of liquids by ultrasonic waves, Physio-chemical effects of ultrasonics, chemical effects of ultrasonics, Thermal effects of ultrasonics, soldering and welding by ultrasonics, Ultrasonic Drying

Text Books:

1. Bogdan M Wilamowski, J David irwin," Fundamentals of Industrial Electronics", 2nd Edition, 2011.
2. G. K. Mithal and Maneesha Gupta," Industrial and Power Electronics", Khanna Publishers, 19th Ed., 2003.

References:

1. J. Millman and C.C Halkias, "Integrated Electronics ", McGraw Hill, 1972.
2. Theodore. H. Bogart," Electronic Devices and circuits" Pearson Education, 6thEdn., 2003.
3. Deboo and Burroughs, "Integrated Circuits and Semiconductor Devices", ISE

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CONSTRUCTION MANAGEMENT (ME, CSE, AI&ML, CS, DS, ECE, EEE)					
Course Code	**L: T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0152T	**3:0:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**OEC**

Course Objectives:

This course will enable students to:

- Be familiar with various construction activities, preparing construction schedule and maintaining documents and records of those activities
- Understand various terms and technologies involved in earthwork of construction activities
- Understand the concepts involved in project management like bar charts and milestone charts
- Understand the concepts of time estimates involved in CPM and PERT, float and slack, critical path calculations

Course Outcomes (CO):

On completion of this course, student will be able to

- Identify the various construction activities like preparing construction schedule and maintaining documents and records of those activities(L2)
- Understand the concepts and techniques involved in earthwork activities(L2)
- Understand about the emerging infectious diseases and aids their management(L2)
- Understand the steps involved in developing a project scheduling and management and the application of bar charts and milestone charts(L2)
- Understand the various elements of a network diagram like event, activity and dummy(L2)
- Understand the concepts of calculation of time estimates of CPM and PERT(L2)

Syllabus		**Total Hours:48**
Module-I	**Fundamentals of Construction Technology**	**9 Hrs**

Definitions and Discussion – Construction Activities –Construction Processes -Construction Works – Construction Estimating – Construction Schedule – Productivity and Mechanized Construction – Construction Documents – Construction Records – Quality – Safety – Codes and Regulations.

Module-II	**Earthwork**	**9 Hrs**

Classification of Soils – Project Site – Development – Setting Out - Mechanized Excavation – Groundwater Control – Trenchless (No-dig) Technology – Grading – Dredging.Rock Excavation – Basic Mechanics of Breakage – Blasting Theory – Drillability of Rocks – Kinds of Drilling – Selection

of the Drilling Method and Equipment – Explosives – Blasting Patterns and Firing Sequence – Smooth Blasting – Environmental Effect of Blasting

Module-III	Project Management and Bar Charts and Milestone Charts	10 Hrs

Project planning – Scheduling – Controlling – Role of decision in project management – Techniques for analyzing alternatives Operation research – Methods of planning and programming problems – Development of bar chart – Illustrative examples – Shortcomings of bar charts and remedial measures – Milestone charts

Module-IV	Elements of Network and Development of Network	10 Hrs

Introduction – Event – Activity – Dummy – Network rules – Graphical guidelines for network – Common partial situations in network – Numbering the events – Cycles Problems.

Module-V	PERT AND CPM	10Hrs

Time estimates – Frequency distribution – Mean, variance and standard deviation-Expected time Problems -Earliest expected time – Formulation for TE - Latest allowable occurrence time – Formulation for TL - Combined tabular computations for TE and TL problems. Introduction - Slack – Critical path-Illustrative examples Problems.

Text Books:
1. Jha," Construction project management", Pearson publications, New Delhi 2nd Edition 2015
2. Subir K. Sarkar and Subhajit Saraswat "Construction Technology", Oxford Higher Education Univ. Press, Delhi 2008 edition

Reference Books:
1. Dr.B.C.Punmia, K.K.Khandelwal ,"Project Planning and Control with PERT and CPM", Lakshmi Publications ,New Delhi 2022 editionDelhi
2. P.R.Bhave,"Optimal Design of Water Distribution Networks" Narosa Publishing house 2003.
3. P.K.JOY,"Total Project Management -The Indian context",Mac Millan Publishers India Limited.

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INTRODUCTION TO ROBOTICS					
Course Code	**L: T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0331Tc	**3:0:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**OEC**

Course Objectives:

The objectives of this course are to Identify robots and its peripherals for satisfactory operation and control of robots for industrial and non-industrial applications.

Course Outcomes (CO):

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

1. List and explain the basic elements of industrial robots(L2)

2. Analyze robot kinematics and its control methods(L4)

3. Classify the various sensors used in robots for better performance(L2)

4. Summarize various industrial and non-industrial applications of robots(L2)

Syllabus		Total Hours:48
Module-I	**Robot Basics**	**10 Hrs**
Automation and Robotics: Robot-Basic concepts, Need, Law, History, Anatomy, specifications. Robot configurations-cartesian, cylinder, polar and articulate. Robot wrist mechanism, Precision, accuracy, repeatability, work and volume of robot.		
Module-II	**Robot Elements**	**10 Hrs**
End effectors-Classification- Types of Mechanical actuation, Gripper design, Robot drive system Types, Position and velocity feedback devices-Robot joints and links-Types, Motion interpolation		
Module-III	**Robot Kinematics and Control**	**9 Hrs**
Robot kinematics – Basics of direct and inverse kinematics, Robot trajectories, 2D and 3D Transformation-Scaling, Rotation, Translation Homogeneous transformation. Control of robot manipulators – Point to point, Continuous Path Control, Robot programming		
Module-IV	**Robot Sensors**	**9 Hrs**
Sensors in robot – Touch sensors -Tactile sensor – Proximity and range sensors. Force sensor-Light sensors, Pressure sensors, Introduction to Machine Vision and Artificial Intelligence.		
Module-V	**Robot Applications**	**10 Hrs**

Industrial applications of robots-Medical, Household, Entertainment, Space, Underwater, Defense, Disaster management. Applications, Micro and Nanorobots, Future Applications.

Text Books:
1. Mikell P. Groover, Mitchell Weiss, Roger N Nagel, Nicholas G Odrey, "Industrial Robotics Technology,
2. Programming and Applications", Tata –McGraw Hill Pub. Co., 2008.

Reference Books:
1. Deb.S.R and Sankha Deb, "Robotics Technology and Flexible Automation", Tata McGraw Hill Publishing Company Limited, 2010.
2. Klafter.R.D, Chmielewski.T.A, and Noggin's., "Robot Engineering: An Integrated   Approach"', Prentice Hall of India Pvt. Ltd., 1994.
3. Fu.K.S, Gonzalez.R.C&Lee.C.S.G, "Robotics control, sensing, vision and intelligence", Tata-McGraw Hill Pub. Co., 2008
4. Yu. "Industrial Robotics", MIR Publishers Moscow, 1985

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Generative AI (AI&ML)					
Course Code	**L: T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A3318P	**1:0:2:0**	**2**	**CIE:30 SEE:70**	**3 Hours**	**SC**

Course Objectives:

This course will enable students to:

- Describe generative AI and how it aligns to machine learning.
- Define the importance of generative AI and explain its potential risks andbenefits.
- Identify business value from generative AI use cases.
- Learn real-world application of Generative AI.
- Apply generative AI models and popular tools

Course Outcomes (CO):

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

- Understand evolution of Generative AI(L2)
- Identify Business Value(L2)
- Learn Capabilities of Generative AI in different Domains(L2)
- Understand Chat GPT(L2)
- Create/Deploying of a Generative AI application(L2)

Syllabus		**Total Hours:48**
Module-I	**Prompt Engineering Fundamentals**	**10Hrs**

Prompt Engineering Fundamentals: Prompt, Elements of a Prompt. Tips for Designing Prompt, Example prompts for various use cases

Module-II	**Generative Texts and Images**	**10 Hrs**

Generative Texts: Introduction to AI Chatbots, Working of AI Chatbots, Popular AI Chatbots, ChatGPT and its working, How to use ChatGPT, Use cases of ChatGPT for varioususers.

Generative Images: Role of AI in Image Generation, Image Sourcing Vs, Image Generation,and Popular AI tools for Image Generation. Mid journey for Image Generation, Working of mid journey, Advantages and disadvantages of Mid journey, How to use Mid journey, Use cases of Mid journey

Module-III	**Generative Videos**	**9 Hrs**

Generative Videos: A: Tools in Video Making, Working of AI Video Makers, Benefits of AIVideo Makers, Popular AI Video Makers, Introduction to Synthesia, Features of Synthesia, Who should use Synthesia? Compatibility of Synthesia, Pros and Cons of Synthesia, How to use Synthesia, How to make AI Videos in 10 minutes, Practical Case studies of Synthesia.

Module-IV		**10 Hrs**

Generative Codes: Role of AI Tools in Programming, Copilot by Github, Working of Copilot, Copilot Compatibility, Advantages and Drawbacks of Copilot, How to use Copilot, How to Install the GitHub Copilot Extension, Converting Comments to Code using Copilot, Auto filling Repetitive Code using Copilot, Running Tests using Copilot, Navigating, Unfamiliar Territory with Copilot, Creating an Application Entirely With Copilot, Some useful keyboard shortcuts for GitHub's Copilot

Module-V	ChatGPT Alternatives	9 Hrs

ChatGPT Alternatives: Alternative Chatbots, Comparison of ChatGPT, Bard, LLAMA,Claude..

List of experiments

1. Text Generation using Generative AI
2. Image Generation using Generative AI
3. Audio Generation using Generative AI
4. Video Generation using Generative AI
5. Code Generation using Generative AI
6. Image to Text Generation using Generative AI
7. Speech to Text generation using Generative AI
8. Develop a Transactional Chatbot using Generative AI
9. Develop a Social Chatbot using Generative AI
10. Develop a Scripted Chatbot using Generative AI

Text Books:
1. Deep Learning" by Ian Good fellow, Yoshua Bengio, and Aaron Courville,1stedition,2016

Reference Books:
3. Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play"by David Foster, 1st edition, 2019
4. "Generative Deep Learning: Deep Learning for Generative Models" by RowelAtienza, 1st edition, 2019 "
5. "Deep Generative Models" by Aaron Courville, Ian Good fellow, and Yoshua Bengio,1st edition, 2020"Generative Adversarial Networks: An Overview" by Anton Bogushevsky and Vladimir

Semester-8 (Project-1)							
Sl. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	C
1	Major Project	22A3311	Project work, Seminar and Internship inindustry	0	0	24	12
INTERNSHIP (6 MONTHS)							
						Total credits	12