

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING			
Course Code	22SAM13	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	3:2:0	SEE Marks	50
Total Hours of Pedagogy	50	Total Marks	100
Credits	04	Exam Hours	03
Course Learning objectives: <ul style="list-style-type: none">To study the concept of Artificial Intelligence and problem solving.To figure out advanced problem solving paradigms and knowledge representation.To explore neural networks, build neural networks to solve various classification problems.			
Module-1			
Introduction, Problem Solving: state space search and control strategies: Introduction, General problem solving, Characteristics of problem, Exhaustive Searches, Heuristic Search Techniques, Iterative Deepening, Constant satisfaction.			
Teaching-Learning Process	Chalk and talk, PPT		
Module-2			
Problem reduction and Game playing, Logic concepts and logic programming: Introduction, Problem reduction, Game playing, Bounded look ahead strategy and Use of, Alpha-Beta Pruning, Two –player perfect information games. Propositional calculus, Propositional logic, Natural Deduction system, Axiomatic system, Semantic tableau system in propositional logic, resolution refutation in propositional logic, Predicate logic, Logic programming			
Teaching-Learning Process	Chalk and talk, PPT		
Module-3			
Advanced problem-solving paradigm: planning- types of planning systems, Block world problem, logic based planning, Linear planning using a goal stack, Means-ends analysis, Non –linear planning strategies. Knowledge representation: Approaches to knowledge representation, knowledge representation using semantic network, Extended semantic networks for KR, Knowledge representation using frames.			
Teaching-Learning Process	Chalk and talk, PPT		
Module-4			
Uncertainty Measure: Probability Theory, Bayesian Belief Networks, Machine Learning Paradigms: Machine learning system, supervised and unsupervised learnings, Inductive, deductive learning, Clustering			
Teaching-Learning Process	Chalk and talk, PPT		
Module-5			
Support vector Machine, case-based reasoning and learning. ANN: Single Layer, Multilayer. RBF, Design issues in ANN, Recurrent Network			
Teaching-Learning Process	Chalk and talk, PPT		

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks** or one **Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Text Books:

1. *Artificial Intelligence*, Saroj Kaushik Cengage Learning 2014 Edition.

Reference Books:

2. *Artificial Intelligence: Structures and Strategies for Complex Problem Solving*, George F Luger Pearson Addison Wesley 6 th Ed, 2008.
3. *Artificial Intelligence*, E Rich, K Knight, and S B Nair Tata Mc-Graw Hill 3rd Ed, 2009.
4. *Artificial Intelligence: A Modern Approach*, Stuart Russell and Peter Norvig Prentice Hall 3rd, 2009.

Web links and Video Lectures (e-Resources):

- <https://nptel.ac.in/courses/106102220>

Skill Development Activities Suggested

The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Define Artificial intelligence and identify problems for AI. Characterize the search techniques to solve problems and recognize the scope of classical search techniques	L2
CO2	Define knowledge and its role in AI. Demonstrate the use of Logic in solving AI problems (can be attained through assignment and CIE)	L3
CO3	Demonstrate handling of uncertain knowledge and reasoning in probability theory. (can be attained through assignment and CIE)	L3
CO4	Have knowledge of Learning methods	L1

Program Outcome of this course

Sl. No.	Description	POs
1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and computer science and business systems to the solution of complex engineering and societal problems.	Po1
2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering and business problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	PO2
3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	PO3
4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	PO4
5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations	PO5
6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering and business practices.	PO6
7	Environment and sustainability: Understand the impact of the professional engineering solutions in business societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	PO7
8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering and business practices.	PO8
9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	PO9
10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	PO10
11	Project management and finance: Demonstrate knowledge and understanding of the engineering, business and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	PO11
12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	PO12

Mapping of COS and POs												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
C01	x	x										
C02	x		x									
C03	x	x										
C04	x	x										

CLOUD COMPUTING			
Course Code	22SAM14	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning objectives: <ul style="list-style-type: none">• To explain the fundamentals of cloud computing• To illustrate the cloud application programming and aneka platform• To Contrast different cloud platforms used in industry			
Module-1			
Introduction, Cloud Infrastructure: Cloud computing, Cloud computing delivery models and services, Ethical issues, Cloud vulnerabilities, Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services, Open-source software platforms for private clouds, Cloud storage diversity and vendor lock-in, Energy use and ecological impact, Service level agreements, User experience and software licensing. Exercises and problems.			
Teaching-Learning Process	Chalk and board /PPT /Web contents		
Module-2			
Cloud Computing: Application Paradigms: Challenges of cloud computing, Architectural styles of cloud computing, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The Zookeeper, The Map Reduce programming model, A case study: The Gre The Web application, Cloud for science and engineering, High-performance computing on a cloud, Cloud computing for Biology research, Social computing, digital content and cloud computing.			
Teaching-Learning Process	Chalk and board /PPT /Web contents		
Module-3			
Cloud Resource Virtualization: Virtualization, Layering and virtualization, Virtual machine monitors, Virtual Machines, Performance and Security Isolation, Full virtualization and paravirtualization, Hardware support for virtualization, Case Study: Xen a VMM based paravirtualization, Optimization of network virtualization, vBlades, Performance comparison of virtual machines, The dark side of virtualization, Exercises and problems			
Teaching-Learning Process	Chalk and board /PPT /Web contents/ Case Study		
Module-4			
Cloud Resource Management and Scheduling: Policies and mechanisms for resource management, Application of control theory to task scheduling on a cloud, Stability of a two-level resource allocation architecture, Feedback control based on dynamic thresholds, Coordination of specialized autonomic performance managers, A utility-based model for cloud-based Web services, Resourcing bundling: Combinatorial auctions for cloud resources, Scheduling algorithms for computing clouds, Fair queuing, Start-time fair queuing, Borrowed virtual time, Cloud scheduling subject to deadlines, Scheduling MapReduce applications subject to deadlines, Resource management and dynamic scaling, Exercises and problems.			
Teaching-Learning Process	Chalk and board /PPT /Weblinks		
Module-5			

Cloud Security, Cloud Application Development: Cloud security risks, Security: The top concern for cloud users, Privacy and privacy impact assessment, Trust, Operating system security, Virtual machine Security, Security of virtualization, Security risks posed by shared images, Security risks posed by a management OS, A trusted virtual machine monitor, Amazon web services: EC2 instances, Connecting clients to cloud instances through firewalls, Security rules for application and transport layer protocols in EC2, How to launch an EC2 Linux instance and connect to it, How to use S3 in java, Cloud-based simulation of a distributed trust algorithm, A trust management service, A cloud service for adaptive data streaming, Cloud based optimal FPGA synthesis .Exercises and problems.	
Teaching-Learning Process	Chalk and board /PPT /Web Contents / Case Study
Assessment Details (both CIE and SEE) The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.	
Continuous Internal Evaluation: <ol style="list-style-type: none"> Three Unit Tests each of 20 Marks Two assignments each of 20 Marks or one Skill Development Activity of 40 marks to attain the COs and POs The sum of three tests, two assignments/skill Development Activities, will be scaled down to 50 marks CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.	
Semester End Examination: <ol style="list-style-type: none"> The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50. The question paper will have ten full questions carrying equal marks. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module. Each full question will have a sub-question covering all the topics under a module. The students will have to answer five full questions, selecting one full question from each module 	
Suggested Learning Resources: Text Books: <ol style="list-style-type: none"> <i>Cloud Computing Theory and Practice</i>, Dan C Marinescu ,Elsevier(MK) 2013. <i>Computing Principles and Paradigms</i>, Rajkumar Buyya , James Broberg, Andrzej Goscinski Willey 2014. Reference Books: <ol style="list-style-type: none"> <i>Cloud Computing Implementation, Management and Security</i>, John W Rittinghouse, James F Ransome CRC Press 2013 	
Web links and Video Lectures (e-Resources): <ul style="list-style-type: none"> https://onlinecourses.nptel.ac.in/noc22_cs87/preview 	
Skill Development Activities Suggested The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.	

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
C01	Compare the strengths and limitations of cloud computing	L2
C02	Identify the architecture, infrastructure and delivery models of cloud computing	L2
C03	Apply suitable virtualization concept (can be attained through assignments and CIE)	L3
C04	Choose the appropriate cloud player	L2
C05	Address the core issues of cloud computing such as security, privacy and interoperability (can be attained through assignments and CIE)	L3

Program Outcome of this course

Sl. No.	Description	POs
1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and computer science and business systems to the solution of complex engineering and societal problems.	Po1
2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering and business problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	PO2
3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	PO3
4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	PO4
5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations	PO5
6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering and business practices.	PO6
7	Environment and sustainability: Understand the impact of the professional engineering solutions in business societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	PO7
8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering and business practices.	PO8
9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	PO9
10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	PO10
11	Project management and finance: Demonstrate knowledge and understanding of the engineering, business and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	PO11

Mapping of COS and POs

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
C01	x	x										
C02	x				x							
C03	x				x							
C04	x			x								
C05		x	x									

BIG DATA ANALYTICS			
Course Code	22SAM15	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning objectives: <ul style="list-style-type: none">• Explore the Hadoop framework and Hadoop Distributed File system• Study HDFS and MapReduce concepts• Employ MapReduce programming model to process the big data• Explore the working of pig and SPARK tool			
Module-1			
Meet Hadoop: Data!, Data Storage and Analysis, Querying All Your Data, Beyond Batch, Comparison with Other Systems: Relational Database Management Systems, Grid Computing, Volunteer Computing Hadoop Fundamentals MapReduce: A Weather Dataset: Data Format, Analyzing the Data with Unix Tools, Analyzing the Data with Hadoop: Map and Reduce, Java MapReduce, Scaling Out: Data Flow, Combiner Functions, Running a Distributed MapReduce Job, Hadoop Streaming The Hadoop Distributed File systemThe Design of HDFS, HDFS Concepts: Blocks, Namenodes and Datanodes, HDFS Federation, HDFS High-Availability, The Command-Line Interface, Basic Filesystem Operations, HadoopFilesystems Interfaces, The Java Interface, Reading Data from a Hadoop URL, Reading Data Using the FileSystem API, Writing Data, Directories, Querying the Filesystem, Deleting Data, Data Flow: Anatomy of a File Read, Anatomy of a File Write.			
Teaching-Learning Process	Chalk and board /PPT /Web Contents		
Module-2			
YARN Anatomy of a YARN Application Run: Resource Requests, Application Lifespan, Building YARN Applications, YARN Compared to MapReduce, Scheduling in YARN: The FIFO Scheduler, The Capacity Scheduler, The Fair Scheduler, Delay Scheduling, Dominant Resource Fairness. Hadoop I/O Data Integrity, Data Integrity in HDFS, Local FileSystem, Checksum File System, Compression, Codecs, Compression and Input Splits, Using Compression in MapReduce, Serialization, The Writable Interface, Writable Classes, Implementing a Custom Writable, Serialization Frameworks, File-Based Data Structures: SequenceFile			
Teaching-Learning Process	Chalk and board /PPT /Web Contents / Case Study		
Module-3			
Developing a MapReduce Application The Configuration API, Combining Resources, Variable Expansion, Setting Up the Development Environment, Managing Configuration, Generic Options Parser, Tool, and Tool Runner, Writing a Unit Test with MRUnit: Mapper, Reducer, Running Locally on Test Data, Running a Job in a Local Job Runner, Testing the Driver, Running on a Cluster, Packaging a Job, Launching a Job, The MapReduce Web UI, Retrieving the Results, Debugging a Job, Hadoop Logs, Tuning a Job, Profiling Tasks, MapReduce Workflows: Decomposing a Problem into MapReduce Jobs, JobControl, Apache Oozie How MapReduce WorksAnatomy of a MapReduce Job Run, Job Submission, Job Initialization, Task Assignment, Task Execution, Progress and Status Updates, Job Completion, Failures: Task Failure, Application Master Failure, Node Manager Failure, Resource Manager Failure, Shuffle and Sort: The Map Side, The Reduce Side, Configuration Tuning, Task Execution: The Task Execution Environment, Speculative Execution, Output Committers.			
Teaching-Learning Process	Chalk and board /PPT /Web Contents / Case Study		
Module-4			

MapReduce Types and Formats: MapReduce Types, Input Formats: Input Splits and Records, Text Input, Binary Input, Multiple Inputs, Database Input (and Output) Output Formats: Text Output, Binary Output, Multiple Outputs, Lazy Output, Database Output, Flume Installing Flume, An Example, Transactions and Reliability, Batching, The HDFS Sink, Partitioning and Interceptors, File Formats, Fan Out, Delivery Guarantees, Replicating and Multiplexing Selectors, Distribution: Agent Tiers, Delivery Guarantees, Sink Groups, Integrating Flume with Applications, Component Catalog.	
Teaching-Learning Process	Chalk and board /PPT /Web Contents
Module-5	
<p>Pig Installing and Running Pig, Execution Types, Running Pig Programs, Grunt, Pig Latin Editors, An Example: Generating Examples, Comparison with Databases, Pig Latin: Structure, Statements, Expressions, Types, Schemas, Functions, Data Processing Operators: Loading and Storing Data, Filtering Data, Grouping and Joining Data, Sorting Data, Combining and Splitting Data.</p> <p>Spark An Example: Spark Applications, Jobs, Stages and Tasks, A Java Example, A Python Example, Resilient Distributed Datasets: Creation, Transformations and Actions, Persistence, Serialization, Shared Variables, Broadcast Variables, Accumulators, Anatomy of a Spark Job Run, Job Submission, DAG Construction, Task Scheduling, Task Execution, Executors and Cluster Managers: Spark on YARN</p>	
Teaching-Learning Process	Chalk and board /PPT /Web Contents / Case Study
<p>Assessment Details (both CIE and SEE)</p> <p>The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.</p> <p>Continuous Internal Evaluation:</p> <ol style="list-style-type: none"> 1. Three Unit Tests each of 20 Marks 2. Two assignments each of 20 Marks or one Skill Development Activity of 40 marks to attain the COs and POs <p>The sum of three tests, two assignments/skill Development Activities, will be scaled down to 50 marks</p> <p>CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.</p> <p>Semester End Examination:</p> <ol style="list-style-type: none"> 1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50. 2. The question paper will have ten full questions carrying equal marks. 3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module. 4. Each full question will have a sub-question covering all the topics under a module. 5. The students will have to answer five full questions, selecting one full question from each module 	
<p>Suggested Learning Resources:</p> <p>Text Books:</p> <ol style="list-style-type: none"> 1. <i>Hadoop: The Definitive Guide</i>, Tom White, O'Reilley 3rd Edition, 2012. 2. <i>SPARK: The Definitive Guide</i>, Bill Chambers Matei Zaharia, O'Reilley 2018. <p>References:</p> <ol style="list-style-type: none"> 1. <i>Apache Flume: Distributed Log Collection for Hadoop</i>, D'Souza and Steve Hoffman O'Reilley 2014. 	
Web links and Video Lectures (e-Resources):	

- https://onlinecourses.nptel.ac.in/noc20_cs92/

Skill Development Activities Suggested

The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
C01	Figure out concepts of managing big data using Hadoop and SPARK technologies	L1
C02	Explain HDFS and MapReduce concepts	L2
C03	Install, configure, and run Hadoop and HDFS	L2
C04	Perform map-reduce analytics using Hadoop and related tools (can be attained through assignments and CIE)	L3
C05	Explain SPARK concepts (can be attained through assignments and CIE)	L3

Program Outcome of this course

Sl. No.	Description	POs
1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and computer science and business systems to the solution of complex engineering and societal problems.	Po1
2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering and business problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	P02
3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	P03
4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	P04
5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations	P05
6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering and business practices.	P06
7	Environment and sustainability: Understand the impact of the professional engineering solutions in business societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	P07
8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering and business practices.	P08
9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	P09
10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	P010
11	Project management and finance: Demonstrate knowledge and understanding of the engineering, business and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	P011
12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	P012

Mapping of COS and POs												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	x											x
C02	x		x									
C03	x		x		x							
C04	x				x							
C05	x				x							

Common to all M tech programs in CSE board			
Research Methodology and IPR			
Course Code	22RMI16	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning objectives: <ul style="list-style-type: none">• To introduce various technologies of conducting research.• To choose an appropriate rsearch design for the choosen problem.• Choose appropriate tool for the conduction of research.• To explain the art of interpretation and the art of writing research reports.• To explain various forms of the intellectual property, its relevance and business impact in the changing global business environment• To discuss leading International Instruments concerning Intellectual Property Rights.			
Module-1			
Research Methodology: Introduction, Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, and Problems Encountered by Researchers in India. Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration			
Teaching-Learning Process	Chalk and talk/PPT/case study		
Module-2			
Reviewing the literature: Place of the literature review in research, Bringing clarity and focus to your research problem, Improving research methodology, Broadening knowledge base in research area, Enabling contextual findings, How to review the literature, searching the existing literature, reviewing the selected literature, Developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed. Research Design: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs.			
Teaching-Learning Process	Chalk and talk/PPT/case study/web content		
Module-3			

Design of Sampling: Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs. Measurement and Scaling: Qualitative and Quantitative Data, Classifications of Measurement Scales, Goodness of Measurement Scales, Sources of Error in Measurement Tools, Scaling, Scale Classification Bases, Scaling Technics, Multidimensional Scaling, Deciding the Scale. Data Collection: Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method.	
Teaching-Learning Process	Chalk and talk/PPT/case study/web content
Module-4	
Testing of Hypotheses: Hypothesis, Basic Concepts Concerning Testing of Hypotheses, Testing of Hypothesis, Test Statistics and Critical Region, Critical Value and Decision Rule, Procedure for Hypothesis Testing, Hypothesis Testing for Mean, Proportion, Variance, for Difference of Two Mean, for Difference of Two Proportions, for Difference of Two Variances, P-Value approach, Power of Test, Limitations of the Tests of Hypothesis. Chi-square Test: Test of Difference of more than Two Proportions, Test of Independence of Attributes, Test of Goodness of Fit, Cautions in Using Chi Square Tests	
Teaching-Learning Process	Chalk and talk/PPT/case study/web content
Module-5	
Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports. Intellectual Property: The Concept, Intellectual Property System in India, Development of TRIPS Complied Regime in India, Patents Act, 1970, Trade Mark Act, 1999, The Designs Act, 2000, The Geographical Indications of Goods (Registration and Protection) Act 1999, Copyright Act, 1957, The Protection of Plant Varieties and Farmers' Rights Act, 2001, The Semi-Conductor Integrated Circuits Layout Design Act, 2000, Trade Secrets, Utility Models, IPR and Biodiversity, The Convention on Biological Diversity (CBD) 1992, Competing Rationales for Protection of IPRs, Leading International Instruments Concerning IPR, World Intellectual Property Organisation (WIPO), WIPO and WTO, Paris Convention for the Protection of Industrial Property, National Treatment, Right of Priority, Common Rules, Patents, Marks, Industrial Designs, Trade Names, Indications of Source, Unfair Competition, Patent Cooperation Treaty (PCT), Advantages of PCT Filing, Berne Convention for the Protection of Literary and Artistic Works, Basic Principles, Duration of Protection, Trade Related Aspects of Intellectual Property Rights (TRIPS) Agreement, Covered under TRIPS Agreement, Features of the Agreement, Protection of Intellectual Property under TRIPS, Copyright and Related Rights, Trademarks, Geographical indications, Industrial Designs, Patents, Patentable Subject Matter, Rights Conferred, Exceptions, Term of protection, Conditions on Patent Applicants, Process Patents, Other Use without Authorization of the Right Holder, Layout-Designs of Integrated Circuits, Protection of Undisclosed Information, Enforcement of Intellectual Property Rights, UNSECO.	
Teaching-Learning Process	Chalk and talk/PPT

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

3. Three Unit Tests each of **20 Marks**
4. Two assignments each of **20 Marks** or one **Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

6. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
7. The question paper will have ten full questions carrying equal marks.
8. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
9. Each full question will have a sub-question covering all the topics under a module.
10. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Text Books:

5. *Research Methodology: Methods and Techniques*, C.R. Kothari, Gaurav Garg, New Age International, 4th Edition, 2018.. Douglas E Comer, "Internetworking with TCP/IP, Principles, Protocols and Architecture," PHI, 6th Edition
6. *Research Methodology a step-by-step guide for beginners*. (For the topic Reviewing the literature under module 2), Ranjit Kumar, SAGE Publications, 3rd Edition, 2011.

Reference Books:

7. *Research Methods: the concise knowledge base*, Trochim, Atomic Dog Publishing, 2005.
8. *Conducting Research Literature Reviews: From the Internet to Paper*, Fink A, Sage Publications, 2009.

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=A7oioOJ4g0Y&list=PLVf5enqoJ-yVQ2RXU16mCfLPf3J_JUfoc

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Conduct research independently	L2
CO2	Choose research designs, sampling designs, measurement and scaling techniques and also different methods of data collections.	L2
CO3	Statistically interpret the data and draw inferences	L2

Mapping of COS and POs

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
C01		x		x								x
C02		x	x									x
C03				x	x							x

Program Outcome of this course

Sl. No.	Description	POs
1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and computer science and business systems to the solution of complex engineering and societal problems.	PO1
2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering and business problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	PO2
3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	PO3
4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	PO4
5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations	PO5
6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering and business practices.	PO6
7	Environment and sustainability: Understand the impact of the professional engineering solutions in business societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	PO7
8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering and business practices.	PO8
9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	PO9
10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	PO10
11	Project management and finance: Demonstrate knowledge and understanding of the engineering, business and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	PO11

12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	PO12
----	---	------

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING LABORATORY			
Course Code	22SAML17	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	1:2:0	SEE Marks	50
Credits	02	Exam Hours	03
Course objective: <ul style="list-style-type: none">Implement and evaluate AI and ML algorithms in and Python programming language.			
Sl.NO	Experiments		
1	Solve the Tic-Tac-Toe Problem using different techniques. Show the improvements obtained from one over the other using better knowledge representation.		
2	Write python program to solve 8-Puzzle Problem using suitable algorithm.		
3	Build a simple chatbot using appropriate algorithms.		
4	Build a machine learning model to solve real world prediction problems using appropriate algorithm.		
5	Build a machine learning model to solve real world classification problems using appropriate algorithm.		
Course outcomes (Course Skill Set): At the end of the course the student will be able to: <ul style="list-style-type: none">Implement and demonstrate AI and ML algorithms.Evaluate different algorithms.			

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 40% of maximum marks in the semester-end examination(SEE). In total of CIE and SEE student has to secure 50% maximum marks of the course.

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8th week of the semester and the second test shall be conducted after the 14th week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

The Sum of **scaled-down** marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University.

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.

Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly

by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 10% Marks allotted to the procedure part to be made zero.

The duration of SEE is 03 hours

DATA AND WEB MINING			
Course Code	22SAM21	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning objectives: <ul style="list-style-type: none">• To describe web mining and understand the need for web mining• To differentiate between Web mining and data mining• To explore different application areas for web mining• To identify different methods to introduce structure to web-based data• To describe Web mining, its objectives, and its benefits• To explore the methods of Web usage mining			
Module-1			
Introduction to Web Data Mining and Data Mining Foundations, Introduction – World Wide Web (WWW), A Brief History of the Web and the Internet, Web Data Mining-Data Mining, Web Mining. Data Mining Foundations – Association Rules and Sequential Patterns – Basic Concepts of Association Rules, Apriori Algorithm- Frequent Itemset Generation, Association Rule Generation, Data Formats for Association Rule Mining, Mining with multiple minimum supports – Extended Model, Mining Algorithm, Rule Generation, Mining Class Association Rules, Basic Concepts of Sequential Patterns, Mining Sequential Patterns on GSP, Mining Sequential Patterns on PrefixSpan, Generating Rules from Sequential Patterns.			
Teaching-Learning Process	Chalk and talk/ PPT/ Web Content		
Module-2			
Supervised and Unsupervised Learning Supervised Learning – Basic Concepts, Decision Tree Induction – Learning Algorithm, Impurity Function, Handling of Continuous Attributes, Classifier Evaluation, Rule Induction – Sequential Covering, Rule Learning, Classification Based on Associations, Naïve Bayesian Classification , Naïve Bayesian Text Classification – Probabilistic Framework, Naïve Bayesian Model . Unsupervised Learning – Basic Concepts , K-means Clustering – K-means Algorithm, Representation of Clusters, Hierarchical Clustering – Single link method, Complete link Method, Average link method, Strength and Weakness.			
Teaching-Learning Process	Chalk and talk/ PPT/ Web Content		
Module-3			
Information Retrieval and Web Search: Basic Concepts of Information Retrieval, Information Retrieval Methods – Boolean Model, Vector Space Model and Statistical Language Model, Relevance Feedback, Evaluation Measures, Text and Web Page Preprocessing – Stopword Removal, Stemming, Web Page Preprocessing, Duplicate, Detection, Inverted Index and Its Compression – Inverted Index, Search using Inverted Index, Index Construction, Index Compression, Latent Semantic Indexing – Singular Value Decomposition, Query and Retrieval, Web Search, Meta Search, Web Spamming.			
Teaching-Learning Process	Chalk and talk/ PPT/ Web Content		
Module-4			

Link Analysis and Web Crawling: Link Analysis – Social Network Analysis, Co-Citation and Bibliographic Coupling, Page Rank Algorithm, HITS Algorithm, Community Discovery-Problem Definition, Bipartite Core Communities, Maximum Flow Communities, Email Communities. Web Crawling – A Basic Crawler Algorithm- Breadth First Crawlers, Preferential Crawlers, Implementation Issues – Fetching, Parsing, Stopword Removal, Link Extraction, Spider Traps, Page Repository, Universal Crawlers, Focused Crawlers, Topical Crawlers, Crawler Ethics and Conflicts.	
Teaching-Learning Process	Chalk and talk/ PPT/ Web Content
Module-5	
Opinion Mining and Web Usage Mining Opinion Mining – Sentiment Classification – Classification based on Sentiment Phrases, Classification Using Text Classification Methods, Feature based Opinion Mining and Summarization – Problem Definition, Object feature extraction, Feature Extraction from Pros and Cons of Format1, Feature Extraction from Reviews of Format 2 and 3, Comparative Sentence and Relation Mining, Opinion Search and Opinion Spam. Web Usage Mining – Data Collection and Preprocessing- Sources and Types of Data, Key Elements of Web usage Data Preprocessing, Data Modeling for Web Usage Mining, Discovery and Analysis of Web usage Patterns -Session and Visitor Analysis, Cluster Analysis and Visitor Segmentation, Association and Correlation Analysis, Analysis of Sequential and Navigation Patterns.	
Teaching-Learning Process	Chalk and talk/ PPT/ Web Content/ case study
<p>Assessment Details (both CIE and SEE)</p> <p>The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.</p> <p>Continuous Internal Evaluation:</p> <ol style="list-style-type: none"> 1. Three Unit Tests each of 20 Marks 2. Two assignments each of 20 Marks or one Skill Development Activity of 40 marks to attain the COs and POs <p>The sum of three tests, two assignments/skill Development Activities, will be scaled down to 50 marks</p> <p>CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.</p> <p>Semester End Examination:</p> <ol style="list-style-type: none"> 1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50. 2. The question paper will have ten full questions carrying equal marks. 3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module. 4. Each full question will have a sub-question covering all the topics under a module. 5. The students will have to answer five full questions, selecting one full question from each module 	

Suggested Learning Resources:**Text Books:**

1. *Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data* by Bing Liu (Springer Publications)

References Books:

1. Data Mining: Concepts and Techniques, Second Edition Jiawei Han, Micheline Kamber (Elsevier Publications)
2. Web Mining:: Applications and Techniques by Anthony Scime
3. Mining the Web: Discovering Knowledge from Hypertext Data by Soumen Chakrabarti

Web links and Video Lectures (e-Resources):

- <https://www.tutorialspoint.com/what-is-web-mining>
- <https://www.geeksforgeeks.org/web-mining/>

Skill Development Activities Suggested

The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Le
C01	Analyse the characteristics of a data sets and their attributes, investigate what transformations and statistical operations can be carried out on each and identify factors that impact on data quality	L2
C02	Investigate a variety of data mining techniques, and identifying their practical applicability to various problem domains (can be attained through assignment and CIE)	L3
C03	Independently research current trends and developments in knowledge discovery related technologies and use this skill to critically analyse publications to assess the relative merits of various technologies (can be attained through assignment and CIE)	L3
C04	Investigate how web search engines crawl, index, rank web content, how the web is structured	L2
C05	Develop an in-depth knowledge of the fundamental web data mining concepts and techniques, and how previously acquired knowledge of data mining applies to the web (can be attained through assignment and CIE)	L3

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	X	x										
C02	X		x									
C03	x		x									
C04	x	x	x									
C05	x	x	x									

Program Outcome of this course

Sl. No.	Description	POs
1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and computer science and business systems to the solution of complex engineering and societal problems.	PO1
2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering and business problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	PO2
3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	PO3
4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	PO4
5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations	PO5
6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering and business practices.	PO6
7	Environment and sustainability: Understand the impact of the professional engineering solutions in business societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	PO7
8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering and business practices.	PO8
9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	PO9
10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	PO10

11	Project management and finance: Demonstrate knowledge and understanding of the engineering, business and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	PO11
12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	PO12

SAM 2022 Syllabus

DEEP LEARNING			
Course Code	22SAM22	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	3:2:0	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 10 hours Lab	Total Marks	100
Credits	04	Exam Hours	03
Course objectives: <ul style="list-style-type: none">• Figure out the context of neural networks and deep learning• Know how to use a neural network• Explore the data needs of deep learning• Have a working knowledge of neural networks and deep learning• Explore the parameters for neural networks			
MODULE-1			
Machine Learning Basics: Learning Algorithms, Capacity, Overfitting and Underfitting, Hyperparameters and Validation Sets, Estimator, Bias and Variance, Maximum Likelihood Estimation, Bayesian Statistics, Supervised Learning Algorithms, Unsupervised Learning Algorithms, Stochastic Gradient Decent, building a Machine Learning Algorithm, Challenges Motivating Deep Learning.			
Teaching-Learning Process	Chalk and board and PPT		
MODULE-2			
Deep Feedforward Networks: Gradient-Based Learning, Hidden Units, Architecture Design, BackPropagation. Regularization: Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, SemiSupervised Learning, Multi-Task Learning, Early Stopping, Parameter Tying and Parameter Sharing, Sparse Representations, Bagging, Dropout.			
Teaching-Learning Process	Chalk and board and PPT		
MODULE-3			
Optimization for Training Deep Models: How Learning Differs from Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms. Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates. Convolutional Networks: The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features.			
Teaching-Learning Process	Chalk and board and PPT		
MODULE-4			
Sequence Modelling: Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks. Long short-term memory			
Teaching-Learning Process	Chalk and board and PPT		

MODULE 5	
Practical Methodology: Performance Metrics, Default Baseline Models, Determining Whether to Gather More Data, Selecting Hyperparameters, Debugging Strategies, Example: Multi-Digit Number Recognition. Applications: Vision, NLP, Speech.	
Teaching-Learning Process	Chalk and board and PPT

PRACTICAL COMPONENT OF IPCC *(May cover all / major modules)*

Sl.NO	Experiments
1	Build Machine Learning model to solve real world regression problems.
2	Build machine learning model to real world binary classification problems.
3	Build simple model to understand overfitting and underfitting conditions.
4	Build simple convolution network to identify hard written character recognition.
5	Analyze performance metrics of the machine learning model.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

CIE for the theory component of IPCC

1. Two Tests each of **20 Marks**
2. Two assignments each of **10 Marks/One Skill Development Activity of 20 marks**
3. Total Marks of two tests and two assignments/one Skill Development Activity added will be CIE for 60 marks, marks scored will be proportionally scaled down to **30 marks**.

CIE for the practical component of IPCC

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The **15 marks** are for conducting the experiment and preparation of the laboratory record, the other **05 marks shall be for the test** conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
- The laboratory test at the end /after completion of all the experiments shall be conducted for 50 marks and scaled down to 05 marks.

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **20 marks**.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

1. The question paper will be set for 100 marks and marks scored will be scaled down proportionately to 50 marks.
2. The question paper will have ten questions. Each question is set for 20 marks.
3. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
4. The students have to answer 5 full questions, selecting one full question from each module.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component).

- The minimum marks to be secured in CIE to appear for SEE shall be the 15 (50% of maximum marks-30) in the theory component and 10 (50% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the

Suggested Learning Resources:**Text Books:**

1. *Deep Learning*, Ian Good fellow and YoshuaBengio MIT Press <https://www.deeplearningbook.org/> 2016.

Reference Books:

2. *Neural Networks: A systematic Introduction*, Raúl Rojas 1996.
3. *Pattern Recognition and machine Learning*, Christopher Bishop 2007.

Web links and Video Lectures (e-Resources):

- <https://www.simplilearn.com/tutorials/deep-learning-tutorial>
- <https://www.kaggle.com/learn/intro-to-deep-learning>
- <https://www.javatpoint.com/deep-learning>

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
C01	Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains.	L1
C02	Implement deep learning algorithms and solve real-world problems.(can be attained through assignment and CIE)	L4
C03	Execute performance metrics of Deep Learning Techniques. (can be attained through assignment and CIE)	L4

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	x		x									
C02	x	x										
C03	x		x									

COMPUTER VISION			
Course Code	22SAM231	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning objectives: <ul style="list-style-type: none">• Explore the fundamentals of computer vision.• Build skills to perform shape analysis and other computer vision operations.			
Module-1			
CAMERAS: Pinhole Cameras, Radiometry – Measuring Light: Light in Space, Light Surfaces, Important Special Cases, Sources, Shadows, And Shading: Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Interreflections: Global Shading Models, Color: The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color.			
Teaching-Learning Process	Chalk and board / Web Content / PPT		
Module-2			
Linear Filters: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Edge Detection: Noise, Estimating Derivatives, Detecting Edges, Texture: Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids, Application: Synthesis by Sampling Local Models, Shape from Texture.			
Teaching-Learning Process	Chalk and board / Web Content / PPT		
Module-3			
The Geometry of Multiple Views: Two Views, Stereopsis: Reconstruction, Human Stereopsis, Binocular Fusion, Using More Cameras, Segmentation by Clustering: What Is Segmentation?, Human Vision: Grouping and Gestalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering,			
Teaching-Learning Process	Chalk and board / Web Content / PPT		
Module-4			
Segmentation by Fitting a Model: The Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem, Robustness, Segmentation and Fitting Using Probabilistic Methods: Missing Data Problems, Fitting, and Segmentation, The EM Algorithm in Practice, Tracking With Linear Dynamic Models: Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association, Applications and Examples.			
Teaching-Learning Process	Chalk and board / Web Content / PPT		
Module-5			

	Geometric Camera Models: Elements of Analytical Euclidean Geometry, Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations, Geometric Camera Calibration: Least-Squares Parameter Estimation, A Linear Approach to Camera Calibration, Taking Radial Distortion into Account, Analytical Photogrammetry, An Application: Mobile Robot Localization, Model- Based Vision: Initial Assumptions, Obtaining Hypotheses by Pose Consistency, Obtaining Hypotheses by pose Clustering, Obtaining Hypotheses Using Invariants, Verification, Application: Registration In Medical Imaging Systems, Curved Surfaces and Alignment.
Teaching-Learning Process	Chalk and board / Web Content / PPT
<p>Assessment Details (both CIE and SEE)</p> <p>The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.</p> <p>Continuous Internal Evaluation:</p> <ol style="list-style-type: none"> 1. Three Unit Tests each of 20 Marks 2. Two assignments each of 20 Marks or one Skill Development Activity of 40 marks to attain the COs and POs <p>The sum of three tests, two assignments/skill Development Activities, will be scaled down to 50 marks</p> <p>CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.</p> <p>Semester End Examination:</p> <ol style="list-style-type: none"> 1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50. 2. The question paper will have ten full questions carrying equal marks. 3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module. 4. Each full question will have a sub-question covering all the topics under a module. 5. The students will have to answer five full questions, selecting one full question from each module 	
<p>Suggested Learning Resources:</p> <p>Text Books:</p> <ol style="list-style-type: none"> 1. <i>Computer Vision – A Modern Approach</i>, David A. Forsyth and Jean Ponce PHI Learning 2009 <p>Reference Books:</p> <ol style="list-style-type: none"> 2. <i>Computer and Machine Vision – Theory, Algorithms and Practicalities</i>, E. R. Davies Elsevier 4th edition, 2013 	
<p>Web links and Video Lectures (e-Resources):</p> <ul style="list-style-type: none"> • https://www.projectpro.io/data-science-in-python-tutorial/computer-vision-tutorial-for-beginners • https://www.javatpoint.com/computer-vision 	

Skill Development Activities Suggested

The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill.

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
C01	Implement fundamental image processing techniques required for computer vision	L3
C02	Perform shape analysis	L2
C03	Implement boundary tracking techniques	L3
C04	Apply chain codes and other region descriptors	L3
C05	Apply Hough Transform for line, circle, and ellipse detections.	L2

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	x		x									
C02	x	x										
C03	x		x									
C04	x		x									
C05	x	x										

Program Outcome of this course

Sl. No.	Description	POs
1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and computer science and business systems to the solution of complex engineering and societal problems.	PO1
2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering and business problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	PO2
3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	PO3
4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	PO4

5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations	PO5
6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering and business practices.	PO6
7	Environment and sustainability: Understand the impact of the professional engineering solutions in business societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	PO7
8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering and business practices.	PO8
9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	PO9
10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	PO10
11	Project management and finance: Demonstrate knowledge and understanding of the engineering, business and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	PO11
12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	PO12

Semester- III

Semester - III			
Artificial Intelligence in Cyber Security			
Course Code	22SAM232	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning Objectives: <ul style="list-style-type: none">• Explore cyber threats and limitations of machine learning in security.• Apply supervised learning algorithms for anomaly detection.• Explore feature generation and the theory of network defense.• Explore types of web abuse and supervised learning for abuse problems.			
Module-1			
Cyber threats and landscape, The cyber attack's economy, What is Machine learning?, Real-world uses of Machine learning in Security, Spam fighting: an iterative approach, Limitations of machine learning in Security, Training algorithms to learn.			
Teaching-Learning Process	Chalk and talk, PPT		
Module-2			
Supervised classification algorithms, Practical consideration in classification, Clustering, When to use anomaly detection versus supervised learning, Intrusion detection with Heuristics, data-driven methods, feature engineering for anomaly detection, anomaly detection with data and algorithms, Challenges of using machine learning in anomaly detection.			
Teaching-Learning Process	Chalk and talk, PPT		
Module-3			
Understanding malware, feature generation, from features to classification, Theory of Network defense, machine learning and network security, building a predictive model to classify network attacks.			
Teaching-Learning Process	Chalk and talk, PPT		
Module-4			
Monetizing the consumer web, types of abuse and the data that can stop them, Supervised learning for abuse problems, clustering abuse, further direction in clustering, defining machine learning system maturity and scalability.			
Teaching-Learning Process	Chalk and talk, PPT		
Module-5			
Data quality, model quality, performance, maintainability, monitoring and alerting, Security and reliability, feedback and usability.			
Teaching-Learning Process	Chalk and talk, PPT		

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- Three Unit Tests each of **20 Marks**
- Two assignments each of **20 Marks** or one Skill Development Activity of **40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
- Each full question will have a sub-question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books:

1. Machine Learning and Security by Clarence Chio, David Freeman ,Released February 2018 Publisher(s): O'Reilly Media, Inc.

References:

1. Hands-On Artificial Intelligence for Cybersecurity by Alessandro Parisi Released August 2019 Publisher(s): Packt Publishing.

Web links and Video Lectures (e-Resources):

- <https://www.youtube.com/watch?v=lp8uy4DyMo&list=PL9ooVrP1hQOGPQVeapGsJCktzIO4DtI4>
- https://www.youtube.com/watch?v=4imsHaI7xEA&list=PL9ooVrP1hOOGHNaCT7_fwe9AabiZI1RiI

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Identify cyber threats and limitations of machine learning in security.	L1
CO2	Apply machine learning methods to detect anomalies.	L3
CO3	Apply feature generation and the theory of network defense.	L2
CO4	Apply supervised learning for abuse problems.	L3

Program Outcome of this course

Sl. No.	Description	POs

Mapping of COS and POs

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010
C01	x		x	x			x			
C02	x	x								
C03	x		x		x					
C04	x	x		x						

PREDICTIVE ANALYSIS			
Course Code	22SAM233	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning objectives: <ul style="list-style-type: none">• Explore various classification and regression models.• Explore working of supervised and unsupervised algorithms.• Identify the best working models to solve real world problems.			
Module-1			
Overview of Supervised Learning: Introduction, Variable Types and Terminology, Two Simple Approaches to Prediction: Linear Methods for Regression and Classification: Introduction, Linear regression models and least squares, , Subset selection , Shrinkage Methods, A Comparison of the Selection and Shrinkage Methods, Linear Discriminant Analysis, Logistic regression. Text Book 1: Chapters 2.1 – 2.3, 3.1 – 3.4, 3.6, 4.1, 4.3 – 4.4			
Teaching-Learning Process	Chalk and board / Web Content / PPT		
Module-2			
Model Assessment and Selection: Bias, Variance, and model complexity, The Bias-variance Decomposition, Optimism of the training error rate, Estimate of In-sample prediction error, The Effective number of parameters, Bayesian approach and BIC, Cross- validation, Boot strap methods, Conditional or Expected Test Error. Text Book 1: Chapters 7.1 – 7.7, 7.10 – 7.12			
Teaching-Learning Process	Chalk and board / Web Content / PPT		
Module-3			
Additive Models, Trees, and Related Methods: Generalized additive models, Tree-Based Methods, Boosting and Additive Trees: Boosting Methods, Exponential Loss and AdaBoost, Example: Spam Data, Numerical Optimization via Gradient Boosting , Illustrations (California Housing , New Zealand Fish, Demographic Data) Text Book 1: Chapters 9.1 – 9.2, 10.4, 10.8, 10.10, 10.13			
Teaching-Learning Process	Chalk and board / Web Content / PPT		
Module-4			
Neural Networks: Introduction, Fitting Neural Networks, Some Issues in Training Neural Networks Support Vector Machines: Introduction, The Support Vector Classifier, Support Vector Machines and Kernels Unsupervised Learning and Random forests: Association rules, Cluster analysis, Details of Random Forests, Random forests and analysis. Text Book 1: Chapters 11.1, 11.3 – 11.5, 12.1 – 12.3, 14.1 – 14.3, 15.1 – 15.4			
Teaching-Learning Process	Chalk and board / Web Content / PPT		
Module-5			
Assessing Performance of a classification Algorithm (t-test, McNemar’s test, Paired t-test, F-test), Analysis of Variance, Creating data for analytics through designed experiments. Text Book 2: Chapter 19			

Teaching-Learning Process	Chalk and board / Web Content / PPT
<p>Assessment Details (both CIE and SEE)</p> <p>The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.</p> <p>Continuous Internal Evaluation:</p> <ol style="list-style-type: none"> 1. Three Unit Tests each of 20 Marks 2. Two assignments each of 20 Marks or one Skill Development Activity of 40 marks to attain the COs and POs <p>The sum of three tests, two assignments/skill Development Activities, will be scaled down to 50 marks</p> <p>CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.</p> <p>Semester End Examination:</p> <ol style="list-style-type: none"> 1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50. 2. The question paper will have ten full questions carrying equal marks. 3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module. 4. Each full question will have a sub-question covering all the topics under a module. 5. The students will have to answer five full questions, selecting one full question from each module 	
<p>Suggested Learning Resources:</p> <p>Text Books:</p> <ol style="list-style-type: none"> 1. <i>The Elements of Statistical Learning-Data Mining, Inference, and Prediction</i> Trevor Hastie, Robert Tibshirani, Jerome Friedman Springer 2009. 2. <i>Introduction to Machine Learning</i>, E. Alpaydin PHI 2010. <p>Reference Books:</p> <ol style="list-style-type: none"> 1. <i>Pattern Recognition and Machine Learning</i>, Christopher M. Bishop Springer 2007. 2. <i>All of statistics</i>, L.Wasserman Springer 2004. 3. <i>An Introduction to statistical learning with applications in R</i>, G. James, D. Witten, T. Hastie, R. Tibshirani Springer 2017 	
<p>Web links and Video Lectures (e-Resources):</p> <ul style="list-style-type: none"> • https://www.udemy.com/tutorial/become-a-python-data-analyst/introduction-to-predictive-analytics-models/ • https://intellipaat.com/blog/what-is-predictive-analytics/ • https://www.youtube.com/watch?v=Kd0C-8q0HkI 	

Skill Development Activities Suggested

The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill.

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Apply Regression and classification models to solve real world problems(can be attained through assignment and CIE)	L3
CO2	Identify and analyze different analytical models	L2
CO3	Identify and apply Additive models to different data science related problems	L2
CO4	Apply Supervised and Unsupervised learning techniques (can be attained through assignment and CIE)	L3
CO5	Choose appropriate assessment evaluation criterion for different analytical methods	L2

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	x		x									
CO2	x	x										
CO3	x		x									
CO4	x		x									
CO5	x	x										

Program Outcome of this course

Sl. No.	Description	POs
1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and computer science and business systems to the solution of complex engineering and societal problems.	PO1
2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering and business problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	PO2
3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	PO3
4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	PO4

5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations	PO5
6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering and business practices.	PO6
7	Environment and sustainability: Understand the impact of the professional engineering solutions in business societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	PO7
8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering and business practices.	PO8
9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	PO9
10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	PO10
11	Project management and finance: Demonstrate knowledge and understanding of the engineering, business and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	PO11
12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	PO12

CYBER SECURITY AND CYBER LAW			
Course Code	22SAM234	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning objectives: <ul style="list-style-type: none">• Define cyber security, cyber law and their roles• Demonstrate cyber security cybercrime and forensics.• Infer legal issues in cybercrime,• Demonstrate tools and methods used in cybercrime and security.• Illustrate evidence collection and legal challenges			
Module-1			
Introduction to Cybercrime: Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals?, Classifications of Cybercrimes, Cybercrime: The Legal Perspectives, Cybercrimes: An Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes, Cybercrime Era: Survival Mantra for the Netizens. Cyberoffenses: How Criminals Plan Them: How Criminals Plan the Attacks, Social Engineering, Cyberstalking, Cybercafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.			
Teaching-Learning Process	Chalk and talk/PPT/case study/web content		
Module-2			
Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops			
Teaching-Learning Process	Chalk and talk/PPT/case study/web content		
Module-3			
Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks. Phishing and Identity Theft: Introduction, Phishing, Identity Theft (ID Theft).			
Teaching-Learning Process	Chalk and talk/PPT/case study/web content		
Module-4			
Understanding Computer Forensics: Introduction, Historical Background of Cyberforensics, Digital Forensics Science, The Need for Computer Forensics, Cyberforensics and Digital Evidence, Forensics Analysis of E-Mail, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Computer Forensics Investigation, Setting up a Computer Forensics Laboratory: Understanding the Requirements, Computer Forensics and Steganography, Relevance of the OSI 7 Layer Model to Computer Forensics, Forensics and Social Networking Sites: The Security/Privacy Threats, Computer Forensics from Compliance Perspective, Challenges in Computer Forensics, Special Tools and Techniques, Forensics Auditing, Antiforensics.			
Teaching-Learning Process	Chalk and talk/PPT/case study/web content		
Module-5			

Introduction to Security Policies and Cyber Laws: Need for An Information Security Policy, Information Security Standards – Iso, Introducing Various Security Policies and Their Review Process, Introduction to Indian Cyber Law, Objective and Scope of the it Act, 2000, Intellectual Property Issues, Overview of Intellectual - Property - Related Legislation in India, Patent, Copyright, Law Related to Semiconductor Layout and Design, Software License.	
Teaching-Learning Process	Chalk and talk/PPT/case study/web content
Assessment Details (both CIE and SEE) <p>The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.</p> <p>Continuous Internal Evaluation:</p> <ol style="list-style-type: none"> Three Unit Tests each of 20 Marks Two assignments each of 20 Marks or one Skill Development Activity of 40 marks to attain the COs and POs <p>The sum of three tests, two assignments/skill Development Activities, will be scaled down to 50 marks</p> <p>CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.</p> <p>Semester End Examination:</p> <ol style="list-style-type: none"> The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50. The question paper will have ten full questions carrying equal marks. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module. Each full question will have a sub-question covering all the topics under a module. The students will have to answer five full questions, selecting one full question from each module 	
Suggested Learning Resources: <p>Text Books</p> <ol style="list-style-type: none"> <i>Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives.</i> Sunit Belapure and Nina Godbole. Wiley India Pvt Ltd. 2013. <i>Introduction to information security and cyber laws.</i> Surya Prakash Tripathi, Ritendra Goyal, Praveen Kumar Shukla. Dreamtech Press. 2015. <p>Reference Books:</p> <ol style="list-style-type: none"> <i>Cybersecurity: Managing Systems, Conducting Testing, and Investigating Intrusions.</i> Thomas J. Mowbray. John Wiley & Sons, <i>Cyber Security Essentials.</i> James Graham, Ryan Olson, Rick Howard. CRC Press, 2010. 	
Web links and Video Lectures (e-Resources): <ul style="list-style-type: none"> https://www.udemy.com/course/cybersecurity-law-policy/ https://www.youtube.com/watch?v=BS5v5Rr-oVo&list=PL-JyKqQx2Atelbm-z4X709scVr9OaHplY <p>Cybersecurity Law is one of the most rapidly growing areas of law, and issues like privacy, cybercrime, bitcoin banking, international legal issues and internet governance are some of the important areas that will be covered in this course.</p>	

Skill Development Activities Suggested

The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Demonstrate cyber security cybercrime and forensics.	L3
CO2	Demonstrate tools and methods used in cybercrime and security.	L3
CO3	Illustrate evidence collection and legal challenges	L2

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	x		x									
CO2			x							x		
CO3		x			x							

Program Outcome of this course

Sl. No.	Description	POs
1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and computer science and business systems to the solution of complex engineering and societal problems.	PO1
2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering and business problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	PO2
3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	PO3
4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	PO4
5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations	PO5
6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering and business practices.	PO6
7	Environment and sustainability: Understand the impact of the professional engineering solutions in business societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	PO7
8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering and business practices.	PO8

9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	PO9
10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	PO10
11	Project management and finance: Demonstrate knowledge and understanding of the engineering, business and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	PO11
12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	PO12

HUMAN COMPUTER INTERACTION			
Course Code	22SAM235	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning objectives: <ul style="list-style-type: none">To figure out the basic knowledge on theories of psychology and on how the human being interacts with (computer) systems.Explore the business function for user interface development			
Module-1			
The User Interface: Introduction, Importance of the User Interface, Importance and benefits of Good Design History of Human Computer Interface. Characteristics of Graphical and Web User Interface: Graphical User Interface, popularity of graphics, concepts of Direct Manipulation, Graphical System advantage and disadvantage, Characteristics of GUI. Web User Interface, popularity of web, Characteristics of Web Interface, Merging of Graphical Business systems& the Web, Principles of User Interface Design			
Teaching-Learning Process	Chalk and board /PPT / Web content		
Module-2			
The User Interface Design Process: Obstacles and Pitfall in the development Process, Usability, The Design Team, Human Interaction with Computers, Important Human Characteristics in Design, Human Consideration in Design, Human Interaction Speeds, Performance versus Preference, Methods for Gaining and Understanding of Users.			
Teaching-Learning Process	Chalk and board /PPT / Web content		
Module-3			
Understanding Business Functions: Business Definitions & Requirement analysis, Determining Business Functions, Design standards or Style Guides, System Training and Documentation, Principles of Good Screen Design: Human considerations in screen Design, interface design goals, test for a good design, screen meaning and purpose, Technological considerations in Interface Design System Menus and Navigation Schemes: Structure, Functions, Context, Formatting, Phrasing and Selecting, Navigating of Menus, Kinds of Graphical Menus Windows Interface: Windows characteristic, Components of Window, Windows Presentation Styles, Types of Windows, Window Management, Web systems.			
Teaching-Learning Process	Chalk and board /PPT / Web content / Case Study		
Module-4			
Device and Screen-Based Control: Device based controls, Operable Controls, Text entry/read- Only Controls, Section Controls, Combining Entry/Selection Controls, Other Operable Controls and Presentation Controls, Selecting proper controls.			
Teaching-Learning Process	Chalk and board /PPT / Web content		
Module-5			
Effective Feedback Guidance and Assistance: Providing the Proper Feedback, Guidance and Assistance Effective Internationalization and Accessibility- International consideration, Accessibility, Create meaningful Graphics, Icons and Images, Colors-uses, possible problems with colours, choosing colors.			
Teaching-Learning Process	Chalk and board /PPT / Web content / Case Study		

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks** or one **Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Text Books:

1. *Fundamentals of Human Computer Interaction*, Andrew Monk 1st Edition.
2. *The Essential Guide to User Interface Design*, Wilbert O. Galitz ,Wiley , Indian Edition.

Reference Books:

1. *Designing the user interfaces*, Ben Shneidermann, Pearson Education Asia 3 rd Edition.
2. *User Interface Design*, Soren Lauesen, Pearson Education.
3. *Essentials of Interaction Design*, Alan Cooper, Robert Riemann, David Cronin Wiley.
4. *Human Computer Interaction*, Alan Dix, Janet Fincay, GreGoryd, Abowd, Russell, Bealg Pearson Education.

Web links and Video Lectures (e-Resources):

- https://www.tutorialspoint.com/human_computer_interface/index.htm

Skill Development Activities Suggested

- The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Demonstrate basic knowledge on theories of psychology and on how the human being interacts with (computer) systems	L3
CO2	Give insight on how knowledge of the human capabilities can influence the way in which we construct technical systems.	L2
CO3	Apply Methods and techniques for design and construction of user interfaces.	L4

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	x		x									
CO2		x		x								
CO3	x		x									

Program Outcome of this course

Sl. No.	Description	POs
1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and computer science and business systems to the solution of complex engineering and societal problems.	PO1
2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering and business problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	PO2
3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	PO3
4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	PO4
5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations	PO5
6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering and business practices.	PO6
7	Environment and sustainability: Understand the impact of the professional engineering solutions in business societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	PO7
8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering and business practices.	PO8
9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	PO9

10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	PO10
11	Project management and finance: Demonstrate knowledge and understanding of the engineering, business and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	PO11
12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	PO12

NATURAL LANGUAGE PROCESSING			
Course Code	22SAM241	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning objectives: <ul style="list-style-type: none">To Analyze the natural language text.To Generate the natural language.To Demonstrate Text mining.To Apply information retrieval techniques.			
Module-1			
OVERVIEW AND LANGUAGE MODELLING: Overview: Origins and challenges of NLP-Language and Grammar-Processing Indian Languages- NLP Applications-Information Retrieval. Language Modelling: Various Grammar-based Language Models-Statistical Language Model.			
Teaching-Learning Process	Chalk and talk/PPT/case study/web content		
Module-2			
WORD LEVEL AND SYNTACTIC ANALYSIS: Word Level Analysis: Regular Expressions-FiniteState Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word Classes-Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar-Constituency- ParsingProbabilistic Parsing.			
Teaching-Learning Process	Chalk and talk/PPT/case study/web content		
Module-3			
Extracting Relations from Text: From Word Sequences to Dependency Paths: Introduction, Subsequence Kernels for Relation Extraction, A Dependency-Path Kernel for Relation Extraction and Experimental Evaluation. Mining Diagnostic Text Reports by Learning to Annotate Knowledge Roles: Introduction, Domain Knowledge and Knowledge Roles, Frame Semantics and Semantic Role Labelling, Learning to Annotate Cases with Knowledge Roles and Evaluations. A Case Study in Natural Language Based Web Search: InFact System Overview, The GlobalSecurity.org Experience.			
Teaching-Learning Process	Chalk and talk/PPT/case study/web content		
Module-4			
Evaluating Self-Explanations in iSTART: Word Matching, Latent Semantic Analysis, and Topic Models: Introduction, iSTART: Feedback Systems, iSTART: Evaluation of Feedback Systems, Textual Signatures: Identifying Text-Types Using Latent Semantic Analysis to Measure the Cohesion of Text Structures: Introduction, Cohesion, Coh-Metrix, Approaches to Analysing Texts, Latent Semantic Analysis, Predictions, Results of Experiments. Automatic Document Separation: A Combination of Probabilistic Classification and Finite-State Sequence Modelling: Introduction, Related Work, Data Preparation, Document Separation as a Sequence Mapping Problem, Results. Evolving Explanatory Novel Patterns for Semantically Based Text Mining: Related Work, A Semantically Guided Model for Effective TextMining.			
Teaching-Learning Process	Chalk and talk/PPT/case study/web content		
Module-5			
INFORMATION RETRIEVAL AND LEXICAL RESOURCES: Information Retrieval: Design features of Information Retrieval Systems-Classical, Non classical, Alternative Models of Information Retrieval – valuation Lexical Resources: World Net-Frame Net- Stemmers-POS Tagger- Research Corpora.			

Teaching-Learning Process	Chalk and talk/PPT/case study/web content
<p>Assessment Details (both CIE and SEE)</p> <p>The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.</p> <p>Continuous Internal Evaluation:</p> <ol style="list-style-type: none"> 1. Three Unit Tests each of 20 Marks 2. Two assignments each of 20 Marks or one Skill Development Activity of 40 marks to attain the COs and POs <p>The sum of three tests, two assignments/skill Development Activities, will be scaled down to 50 marks</p> <p>CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.</p> <p>Semester End Examination:</p> <ol style="list-style-type: none"> 1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50. 2. The question paper will have ten full questions carrying equal marks. 3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module. 4. Each full question will have a sub-question covering all the topics under a module. 5. The students will have to answer five full questions, selecting one full question from each module <p>Suggested Learning Resources:</p> <p>Text Books</p> <ol style="list-style-type: none"> 1. <i>Natural Language Processing and Information Retrieval</i>, Tanveer Siddiqui, U.S. Tiwary, Oxford University Press, 2008. 2. <i>Natural Language Processing and Text Mining</i>. Anne Kao and Stephen R. Potee, Springer-Verlag London Limited. 2007. <p>Reference Books:</p> <ol style="list-style-type: none"> 1. <i>Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition</i>. Daniel Jurafsky and James H Martin. Prentice Hall, 2008 2nd Edition. 2. <i>Natural Language Understanding</i>. James Allen. Benjamin/Cumming publishing company, 2nd edition, 1995. 3. <i>Information Storage and Retrieval systems</i>. Gerald J. Kowalski and Mark.T. Maybury. Kluwer academic Publishers, 2000. 4. <i>Natural Language Processing with Python</i>. Steven Bird, Ewan Klein, Edward Loper. O'Reilly Media, 2009. <p>Web links and Video Lectures (e-Resources):</p>	

- <https://www.youtube.com/watch?v=fM4qTMfCoak&list=PLZoTAE LR MX VM d J 5 sq b C K 2 L i M 0 H h Q V W N z m>

This course focuses on learning key concepts, tools and methodologies for natural language processing with an emphasis on hands-on learning through guided tutorials and real-world examples.

Skill Development Activities Suggested

The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Analyze the natural language text.	L1
CO2	Generate the natural language.	L2
CO3	Demonstrate Text mining.	L2

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	x	x										
CO2				x						x		
CO3			x		x							

Program Outcome of this course

Sl. No.	Description	POs
1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and computer science and business systems to the solution of complex engineering and societal problems.	PO1
2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering and business problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	PO2
3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	PO3
4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	PO4
5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations	PO5
6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering and business practices.	PO6

7	Environment and sustainability: Understand the impact of the professional engineering solutions in business societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	PO7
8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering and business practices.	PO8
9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	PO9
10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	PO10
11	Project management and finance: Demonstrate knowledge and understanding of the engineering, business and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	PO11
12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	PO12

PATTERN RECOGNITION			
Course Code	22SAM242	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning objectives: <ul style="list-style-type: none">• Explain pattern recognition principals• Develop algorithms for Pattern Recognition.• Develop and analyse decision tress.• Design the nearest neighbour classifier.• Apply Decision tree and clustering techniques to various applications			
Module-1			
Introduction: Definition of PR, Applications, Datasets for PR, Different paradigms for PR, Introduction to probability, events, random variables, Joint distributions and densities, moments. Estimation minimum risk estimators, problems			
Teaching-Learning Process	Chalk and talk/PPT/case study/web content		
Module-2			
Representation: Data structures for PR, Representation of clusters, proximity measures, size of patterns, Abstraction of Data set, Feature extraction, Feature selection, Evaluation			
Teaching-Learning Process	Chalk and talk/PPT/case study/web content		
Module-3			
Nearest Neighbour based classifiers & Bayes classifier: Nearest neighbour algorithm, variants of NN algorithms, use of NN for transaction databases, efficient algorithms, Data reduction, prototype selection, Bayes theorem, minimum error rate classifier, estimation of probabilities, estimation of probabilities, comparison with NNC, Naive Bayes classifier, Bayesian belief network			
Teaching-Learning Process	Chalk and talk/PPT/case study/web content		
Module-4			
Naive Bayes classifier, Bayesian belief network, Decision Trees: Introduction, DT for PR, Construction of DT, splitting at the nodes, Over fitting & Pruning, Examples , Hidden Markov models: Markov models for classification, Hidden Markov models and classification using HMM			
Teaching-Learning Process	Chalk and talk/PPT/case study/web content		
Module-5			
Clustering: Hierarchical (Agglomerative, single/complete/average linkage, wards, Partitional (Forgy's, kmeans, Isodata), clustering large data sets, examples, An application: Handwritten Digit recognition			
Teaching-Learning Process	Chalk and talk/PPT/case study/web content		

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Text Books:

1. *Pattern Recognition (An Introduction)*, V Susheela Devi, M Narsimha Murthy, Universities press, 2011.
2. *Pattern Recognition & Image Analysis*, Earl Gose, Richard Johnsonbaugh, Steve Jost, PH, 1996.

Reference Books:

1. *Pattern Classification*, Duda R. O., P.E. Hart, D.G. Stork, John Wiley and sons, 2000.

Web links and Video Lectures (e-Resources):

- <https://www.youtube.com/watch?v=mfePdDh9t6Q&list=PLbMVogVj5nIQIMLb2CYw9rry0d5s0TQRp>

Skill Development Activities Suggested

The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Choose algorithms for Pattern Recognition.	L2
CO2	Analyse decision tress.	L2
CO3	Design the nearest neighbour classifier.	L2

Mapping of COS and POs												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01			x		x							
C02		x	x									
C03			x		x							

Program Outcome of this course

Sl. No.	Description	POs
1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and computer science and business systems to the solution of complex engineering and societal problems.	PO1
2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering and business problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	PO2
3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	PO3
4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	PO4
5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations	PO5
6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering and business practices.	PO6
7	Environment and sustainability: Understand the impact of the professional engineering solutions in business societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	PO7
8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering and business practices.	PO8
9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	PO9
10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	PO10
11	Project management and finance: Demonstrate knowledge and understanding of the engineering, business and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	PO11
12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	PO12

BLOCKCHAIN TECHNOLOGY			
Course Code	22SAM243	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning objectives: <ul style="list-style-type: none">To explore the driving force behind the cryptocurrency Bitcoin. Along with the Decentralization,			
Module-1			
Blockchain 101: Distributed systems, History of blockchain, Introduction to blockchain, Types of blockchain, CAP theorem and blockchain, Benefits and limitations of blockchain.			
Teaching-Learning Process	Chalk and talk/PPT/case study/web content		
Module-2			
Decentralization and Cryptography: Decentralization using blockchain, Methods of decentralization, Routes to decentralization, Decentralized organizations. Cryptography and Technical Foundations: Cryptographic primitives, Asymmetric cryptography, Public and private keys			
Teaching-Learning Process	Chalk and talk/PPT/case study/web content		
Module-3			
Bitcoin and Alternative Coins A: Bitcoin, Transactions, Blockchain, Bitcoin payments B: Alternative Coins, Theoretical foundations, Bitcoin limitations, Namecoin, Litecoin, Primecoin, Zcash			
Teaching-Learning Process	Chalk and talk/PPT/case study/web content		
Module-4			
Smart Contracts and Ethereum 101: Smart Contracts: Definition, Ricardian contracts. Ethereum 101:Introduction, Ethereum blockchain, Elements of the Ethereum blockchain, Precompiled contracts.			
Teaching-Learning Process	Chalk and talk/PPT/case study/web content		
Module-5			
Alternative Blockchains: Blockchains Blockchain-Outside of Currencies: Internet of Things, Government, Health, Finance, Media			
Teaching-Learning Process	Chalk and talk/PPT/case study/web content		

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Text Books:

1. *Bitcoin and Cryptocurrency Technologies*, Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder, Princeton University, 2016

Reference Books:

1. *Blockchain Basics: A Non-Technical Introduction in 25 Steps*, Daniel Drescher, Apress, First Edition, 2017
2. *Mastering Bitcoin: Unlocking Digital Cryptocurrencies*, Andreas M. Antonopoulos, O'Reilly Media, First Edition, 2014

Web links and Video Lectures (e-Resources):

- <https://nptel.ac.in/courses/106105184>
- https://ocw.mit.edu/courses/15-s12-blockchain-and-money-fall-2018/video_galleries/video-lectures/

Skill Development Activities Suggested

The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
C01	Interpret the types, benefits and limitation of blockchain.	L1
C02	Explore the blockchain decentralization and cryptography concepts.	L2
C03	Enumerate the Bitcoin features and its alternative options.	L1

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01		x		x			x					
C02	x			x								
C03		x								x		

Program Outcome of this course

Sl. No.	Description	POs
1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and computer science and business systems to the solution of complex engineering and societal problems.	PO1
2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering and business problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	PO2
3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	PO3
4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	PO4
5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations	PO5
6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering and business practices.	PO6
7	Environment and sustainability: Understand the impact of the professional engineering solutions in business societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	PO7
8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering and business practices.	PO8
9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	PO9
10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	PO10

11	Project management and finance: Demonstrate knowledge and understanding of the engineering, business and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	PO11
12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	PO12

AGILE TECHNOLOGIES			
Course Code	22SAM244	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning objectives: <ul style="list-style-type: none">To interpret the fundamental principles and practices associated with each of the agile development methods.To apply the principles and practices of agile software development on a project of interest.To interpret how agile methods reduce risk via incremental learning and delivery.			
Module-1			
Why Agile?: Understanding Success, Beyond Deadlines, The Importance of Organizational Success, Enter Agility, How to Be Agile?: Agile Methods, Don't Make Your Own Method, The Road to Mastery, Find a Mentor			
Teaching-Learning Process	Chalk and talk/PPT/case study/web content		
Module-2			
Understanding XP: The XP Lifecycle, The XP Team, XP Concepts, Adopting XP: Is XP Right for Us?, Go!, Assess Your Agility			
Teaching-Learning Process	Chalk and talk/PPT/case study/web content		
Module-3			
Practicing XP: Thinking: Pair Programming, Energized Work, Informative Workspace, Root-Cause Analysis, Retrospectives, Collaborating: Trust, Sit Together, Real Customer Involvement, Ubiquitous Language, Stand-Up Meetings, Coding Standards, Iteration Demo, Reporting,Releasing:"Done Done", No Bugs, Version Control, Ten-Minute Build, Continuous Integration, Collective Code Ownership, Documentation. Planning: Vision, Release Planning, The Planning Game, Risk Management, Iteration Planning, Slack, Stories, Estimating. Developing: Incremental requirements, Customer Tests, TestDriven Development, Refactoring, Simple Design ,Incremental Design and Architecture, Spike Solutions, Performance Optimization, Exploratory Testing			
Teaching-Learning Process	Chalk and talk/PPT/case study/web content		
Module-4			
Mastering Agility: Values and Principles: Commonalities, About Values, Principles, and Practices, Further Reading, Improve the Process: Understand Your Project, Tune and Adapt, Break the Rules, Rely on People :Build Effective Relationships, Let the Right People Do the Right Things, Build the Process for the People, Eliminate Waste :Work in Small, Reversible Steps, Fail Fast, Maximize Work Not Done, Pursue Throughput			
Teaching-Learning Process	Chalk and talk/PPT/case study/web content		
Module-5			
Deliver Value: Exploit Your Agility, Only Releasable Code Has Value, Deliver Business Results, Deliver Frequently, Seek Technical Excellence :Software Doesn't Exist, Design Is for Understanding, Design Trade-offs, Quality with a Name, Great Design, Universal Design Principles, Principles in Practice, Pursue Mastery			
Teaching-Learning	Chalk and talk/PPT/case study/web content		

Process		
Assessment Details (both CIE and SEE) The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.		
Continuous Internal Evaluation: <div><div>1. Three Unit Tests each of 20 Marks</div><div>2. Two assignments each of 20 Marks or one Skill Development Activity of 40 marks to attain the COs and POs</div></div> The sum of three tests, two assignments/skill Development Activities, will be scaled down to 50 marks CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.		
Semester End Examination: <div><div>1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.</div><div>2. The question paper will have ten full questions carrying equal marks.</div><div>3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.</div><div>4. Each full question will have a sub-question covering all the topics under a module.</div><div>5. The students will have to answer five full questions, selecting one full question from each module</div></div>		
Suggested Learning Resources: Text Books: <div>1. <i>The Art of Agile Development</i>, James shore, Chromatic, O'Reilly 2007</div> Reference Books: <div>1. <i>Agile Software Development, Principles, Patterns, and Practices</i>, Robert C. Martin Prentice Hall 1st edition, 2002</div> <div>2. <i>Agile and Iterative Development A Manger's Guide</i>, Craig Larman Pearson Education First Edition, India, 2004</div>		
Web links and Video Lectures (e-Resources): <div><div><div>https://www.tutorialspoint.com/agile/index.htm</div><div>https://www.javatpoint.com/agile</div><div>https://www.udemy.com/topic/agile/free/</div></div></div>		
Skill Development Activities Suggested The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.		
Course outcome (Course Skill Set) At the end of the course the student will be able to :		
Sl. No.	Description	Blooms Level
CO1	Define XP Lifecycle, XP Concepts, Adopting XP	L1
CO2	Examine on Pair Programming, Root-Cause Analysis, Retrospectives, Planning, Incremental Requirements, Customer Tests	L3
CO3	Demonstrate concepts to Eliminate Waste	L3

Mapping of COS and POs												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO11
C01	x						x					
C02		x			x							
C03			x		x							

Program Outcome of this course

Sl. No.	Description	POs
1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and computer science and business systems to the solution of complex engineering and societal problems.	PO1
2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering and business problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	PO2
3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	PO3
4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	PO4
5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations	PO5
6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering and business practices.	PO6
7	Environment and sustainability: Understand the impact of the professional engineering solutions in business societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	PO7
8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering and business practices.	PO8
9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	PO9
10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	PO10
11	Project management and finance: Demonstrate knowledge and understanding of the engineering, business and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	PO11
12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	PO12

VIRTUAL REALITY			
Course Code	22SAM245	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning objectives: <ul style="list-style-type: none">• Explore how the design of VR technology relates to human perception and cognition.• Discuss applications of VR to the conduct of scientific research, training, and industrial design.• Figure out the fundamental aspects of designing and implementing rigorous empirical experiments using VR.• Explore about multimodal virtual displays for conveying and presenting information and techniques for evaluating good and bad virtual interfaces.			
Module-1			
Definition of VR, modern experiences, historical perspective. Hardware, sensors, displays, software, virtual world generator, game engines, human senses, perceptual psychology, psychophysics. Geometric modelling, transforming rigid bodies, yaw, pitch, roll, axis-angle representation, quaternions, 3D rotation inverses and conversions, homogeneous transforms, transforms to displays, look-at and eye transforms, canonical view and perspective transforms, viewport transforms.			
Teaching-Learning Process	Chalk and board /PPT / Web content		
Module-2			
Light propagation, lenses and images, diopters, spherical aberrations, optical distortion; more lens aberrations; spectral properties; the eye as an optical system; cameras; visual displays. Parts of the human eye, photoreceptors and densities, scotopic and photopic vision, display resolution requirements, eye movements, neural vision structures, sufficient display resolution, other implications of physiology on VR. Depth perception, motion perception, vection, stroboscopic apparent motion, color perception, combining information from multiple cues and senses, implications of perception on VR.			
Teaching-Learning Process	Chalk and board /PPT / Web content		
Module-3			
Graphical rendering, ray tracing, shading, BRDFs, rasterization, barycentric coordinates, VR rendering problems, anti-aliasing, distortion shading, image warping (time warp), panoramic rendering. Velocities, acceleration, vestibular system, virtual world physics, simulation, collision detection, avatar motion, vection			
Teaching-Learning Process	Chalk and board /PPT / Web content		
Module-4			
Tracking systems, estimating rotation, IMU integration, drift errors, tilt and yaw correction, estimating position, camera-feature detection model, perspective n-point problem, sensor fusion, lighthouse approach, attached bodies, eye tracking, inverse kinematics, map building, SLAM. Remapping, locomotion, manipulation, social interaction, specialized interaction mechanisms.			
Teaching-Learning Process	Chalk and board /PPT / Web content		
Module-5			

	Sound propagation, ear physiology, auditory perception, auditory localization; Fourier analysis; acoustic modelling, HRTFs, rendering, auralization. Perceptual training, recommendations for developers, best practices, VR sickness, experimental methods that involve human subjects Touch, haptics, taste, smell, robotic interfaces, telepresence, brain-machine interfaces
Teaching-Learning Process	Chalk and board /PPT / Web content / Case study
<p>Assessment Details (both CIE and SEE)</p> <p>The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.</p> <p>Continuous Internal Evaluation:</p> <ol style="list-style-type: none"> 1. Three Unit Tests each of 20 Marks 2. Two assignments each of 20 Marks or one Skill Development Activity of 40 marks to attain the COs and POs <p>The sum of three tests, two assignments/skill Development Activities, will be scaled down to 50 marks</p> <p>CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.</p> <p>Semester End Examination:</p> <ol style="list-style-type: none"> 1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50. 2. The question paper will have ten full questions carrying equal marks. 3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module. 4. Each full question will have a sub-question covering all the topics under a module. 5. The students will have to answer five full questions, selecting one full question from each module 	
<p>Suggested Learning Resources:</p> <p>Books</p> <ol style="list-style-type: none"> 1. VIRTUAL REALITY http://vr.cs.uiuc.edu/book.html Steven M. LaValle. Cambridge University Press 2016. 2. HANDBOOK OF VIRTUAL ENVIRONMENTS: Design, Implementation, and Applications Kelly S. Hale Kay M. Stanney CRC Press 2 nd Edition, 2015. 	
<p>Web links and Video Lectures (e-Resources):</p> <ul style="list-style-type: none"> • https://www.youtube.com/watch?v=WzfDo2Wpxks • https://www.simplilearn.com/tutorials/artificial-intelligence-tutorial/what-is-virtual-reality 	

Skill Development Activities Suggested

- The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
C01	Explain fundamentals of virtual reality systems	L1
C02	Summarize the hardware and software of the VR	L2
C03	Analyse the applications of VR	L2

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	x	x										
C02	x	x			x							
C03	x	x			x							

Program Outcome of this course

Sl. No.	Description	POs
1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and computer science and business systems to the solution of complex engineering and societal problems.	PO1
2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering and business problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	PO2
3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	PO3
4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	PO4
5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations	PO5
6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering and business practices.	PO6

7	Environment and sustainability: Understand the impact of the professional engineering solutions in business societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	PO7
8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering and business practices.	PO8
9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	PO9
10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	PO10
11	Project management and finance: Demonstrate knowledge and understanding of the engineering, business and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	PO11
12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	PO12

DATA AND WEB MINING LABORATORY			
Course Code	22SAML26	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	1:2:0	SEE Marks	50
Credits	02	Exam Hours	03
Course objective: <ul style="list-style-type: none"> The Data Object Exploration and visualization The pre-processing on new and existing datasets. Frequent item set generation and association rules on transactional data. The data model creation by using various classification and clustering algorithms. The data models accuracy analysis by varying the sample size. 			
Sl.NO	Experiments		
1	DATA OBJECT, MATRIX OPERATIONS USING NUMPY Introduction to Python libraries for Data Mining: NumPy, SciPy, Pandas, Matplotlib, Scikit, Learn Write a Python program to do the following operations: Library: NumPy a. Create multidimensional arrays and find its shape and dimension b. Create a matrix full of zeros and ones c. Reshape and flatten data in the array d. Append data vertically and horizontally e. Apply indexing and slicing on array f. Use statistical functions on array, Min, Max, Mean, Median and Standard Deviation		
2	DATA OBJECT, MATRIX OPERATIONS USING NUMPY Write a Python program to do the following operations: Library: NumPy a. Dot and matrix product of two arrays b. Compute the Eigen values of a matrix c. Solve a linear matrix equation such as $3 * x_0 + x_1 = 9$, $x_0 + 2 * x_1 = 8$ d. Compute the multiplicative inverse of a matrix e. Compute the rank of a matrix f. Compute the determinant of an array		
3	EXPLORATION AND VISUALIZATION OF DATA Write a Python program to do the following operations: Data set: brain_size.csv Library: Pandas a. Loading data from CSV file b. Compute the basic statistics of given data, shape, no. of columns, mean c. Splitting a data frame on values of categorical variables d. Visualize each attribute		
4	EXPLORATION OF DATA, CORRELATION Write a python program to load the dataset and understand the input data Dataset: Pima Indians Diabetes Dataset Library: Scipy a. Load data, describe the given data and identify missing, outlier data items. b. Find correlation among all attributes. c. Visualize correlation matrix.		
5	DATA PREPROCESSING – HANDLING MISSING VALUES Write a python program to impute missing values with various techniques on given dataset. a. Remove rows/ attributes b. Replace with mean or mode c. Write a python program to Perform transformation of data using Discretization (Binning) and normalization (MinMaxScaler or MaxAbsScaler) on given dataset.		
6	ASSOCIATION RULE MINING, APRIORI Write a python program to find rules that describe associations by using Apriori algorithm between different products given as 7500 transactions at a French retail store. Libraries: NumPy, SciPy, Matplotlib, Pandas Dataset: https://drive.google.com/file/d/1y5DYn0dGoSbC22xowBq2d4po6h1JxcTQ/view?usp=sharing a. Display top 5 rows of data		

	b. Find the rules with min_confidence: 0.2, min_support= 0.0045, min_lift=3, min_length=2
7	<p>CLASSIFICATION – DECISION TREE</p> <p>Classification of Bank Marketing Data The data is related with direct marketing campaigns of a Portuguese banking institution. The marketing campaigns were based on phone calls. Often, more than one contact to the same client was required, in order to access if the product (bank term deposit) would be ('yes') or not ('no') subscribed. The dataset provides the bank customers" information. It includes 41,188 records and 21 fields. The classification goal is to predict whether the client will subscribe (1/0) to a term deposit (variable y). Libraries: Pandas, NumPy, Sklearn, Seaborn Write a python program to</p> <ol style="list-style-type: none"> Explore data and visualize each attribute Predict the test set results and find the accuracy of the model Visualize the confusion matrix Compute precision, recall, F-measure and support.
<p>Course outcomes (Course Skill Set):</p> <p>At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> Do the pre-processing of dataset Build data models using various algorithms Analyze the accuracy of various models with different sample sizes 	

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 40% of maximum marks in the semester-end examination (SEE). In total of CIE and SEE student has to secure 50% maximum marks of the course.

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8th week of the semester and the second test shall be conducted after the 14th week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

The Sum of **scaled-down** marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University.

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.

Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly

by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 10% Marks allotted to the procedure part to be made zero.

The duration of SEE is 03 hours

SAM 2022 Syllabus