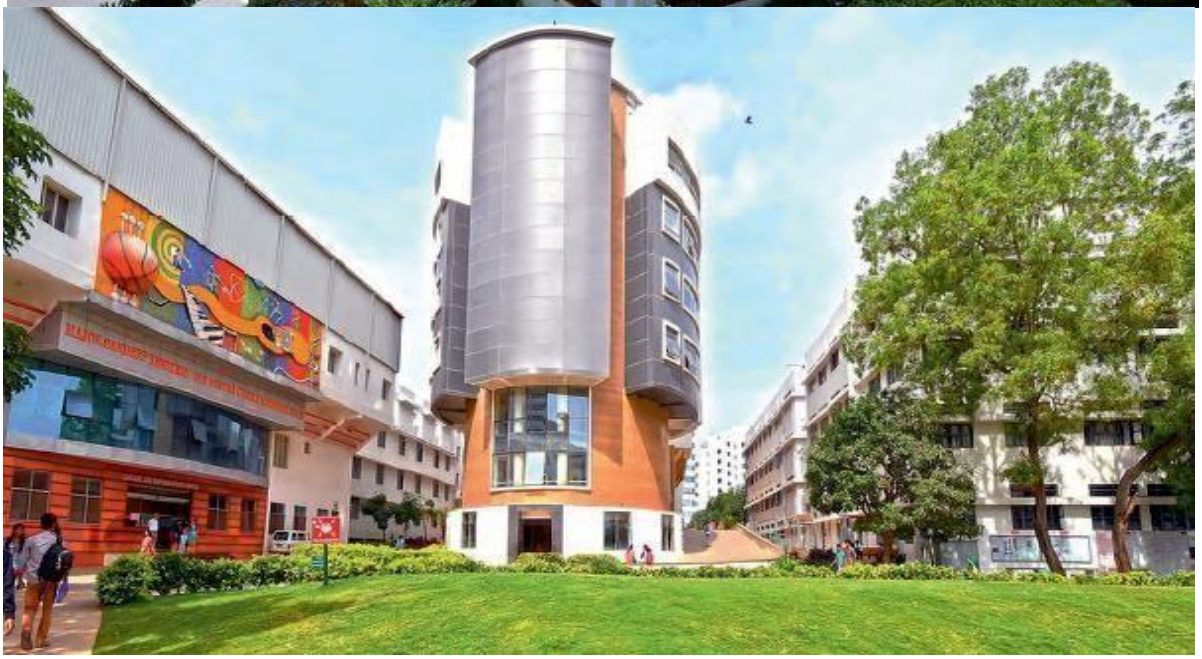
NEW HORIZON
COLLEGE OF ENGINEERING

Autonomous College, Affiliated to VTU | Approved by AICTE New Delhi & UGC
Accredited by NAAC with 'A' Grade & Accredited by NBA



DEPARTMENT OF ARTIFICIALINTELLIGENCE AND MACHINE LEARNING

BATCH: 2020-24 [CREDITS: 175]

[2018 Scheme]

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

1st to 8th Semesters Scheme
Fifth (5th) and Sixth(6th) Semester Syllabus
Academic Year 2022-2023

BATCH: 2020-24

CREDITS: 175

[2018 Scheme]

INSTITUTION

Vision

To emerge as an institute of eminence in the fields of engineering, technology and management in serving the industry and the nation by empowering students with a high degree of technical, managerial and practical competence.

Mission

To strengthen the theoretical, practical and ethical dimensions of the learning process by fostering a culture of research and innovation among faculty members and students.

To encourage long-term interaction between the academia and industry through their involvement in the design of curriculum and its hands-on implementation.

To strengthen and mould students in professional, ethical, social and environmental dimensions by encouraging participation in co-curricular and extracurricular activities. To develop value based socially responsible professionals for the betterment of the society

Quality Policy

To emerge as an institute of eminence in the fields of engineering, technology and management in serving the industry and the nation by empowering students with a high degree of technical, managerial and practical competence.

Values

- Academic Freedom
- Innovation
- Integrity
- Professionalism
- Inclusiveness
- Social Responsibility

DEPARTMENT OF AI & ML

Vision

To develop an outstanding AI and ML professionals with profound practical, research & managerial skills to meet ever changing Industrial Social and Technological needs of the Society

Mission

To provide strong theoretical foundations and hands-on competence in Artificial Intelligence and Machine Learning, fostering research, innovation, and technical excellence in alignment with industry and national needs.

To establish sustainable academia–industry collaboration for curriculum enrichment, real-time problem solving, internships, and emerging AI technology implementation.

To develop ethically responsible, socially conscious, and environmentally aware AI professionals through holistic learning and active participation in co-curricular and professional activities.

Program Educational Objectives (PEOs)

PEO1	Graduates will build successful careers in Artificial Intelligence and Machine Learning by applying strong theoretical foundations, analytical skills, and modern tools to solve complex industrial and societal problems.
PEO2	Graduates will pursue higher education, research, entrepreneurship, or leadership roles in emerging AI technologies through continuous learning, innovation, and industry collaboration.
PEO3	Graduates will demonstrate ethical responsibility, environmental awareness, and social consciousness while developing and deploying AI solutions for sustainable societal impact.

PEO to Mission Statement Mapping

Mission Statements	PEO1	PEO2	PEO3
To provide strong theoretical foundations and hands-on competence in Artificial Intelligence and Machine Learning, fostering research, innovation, and technical excellence in alignment with industry and national needs.	✓	✓	-
To establish sustainable academia–industry collaboration for curriculum enrichment, real-time problem solving, internships, and emerging AI technology implementation	✓	✓	-
To develop ethically responsible, socially conscious, and environmentally aware AI professionals through holistic learning and active participation in co-curricular and professional activities.	-	-	✓

Program Outcomes (POs) with Graduate Attributes

PO1 **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems in reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 **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.

PO4 **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.

PO5 **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.

PO6 **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 practice.

PO7 **Environment and Sustainability**: Understand the impact of the professional engineering solution in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8 **Ethics:** Apply ethical principles and commit to professional ethics, responsibilities, and norms of the Engineering practice.

PO9 **Individual and Team Work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 **Communication Skills**: Communicate effectively on complex engineering activities with the engineering community and with society, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11 **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering 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.

PO12 **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.

Program Specific Outcomes (PSOs)

A graduate of the Artificial Intelligence and Machine Learning Program will demonstrate:

PSO1: Ability to design, develop, and deploy intelligent systems using machine learning algorithms, deep learning architectures, data analytics, and AI frameworks to address real-world applications.

PSO2: Ability to analyze large-scale data, interpret model outcomes, and implement responsible, secure, and ethical AI solutions aligned with industry standards and societal needs.

I SEMESTER – PHYSICS CYCLE												
S.No	Course Code	Course	BOS	Credit Distribution				Overall Credits	Contact Hours	Marks		
				L	T	P	S			CIE	SEE	Total
1	19MAT11A	Applied Mathematics-I	BS	2	1	0	0	3	4	50	50	100
2	19PHY12A	Engineering Physics	BS	3	0	0	0	3	3	25	25	50
3	19MEE13A	Elements of Mechanical Engineering	HSS	3	0	0	0	3	3	25	25	50
4	19CIV14A	Elements of Civil Engineering	CV	3	0	0	0	3	3	50	50	100
5	19EEE15A	Basic Electrical Engineering	EE	3	0	0	0	3	3	50	50	100
6	19PHL16A	Engineering Physics Lab	BS	0	0	2	0	2	4	50	50	100
7	19PEE17A	Basic Electrical Engineering Lab	EE	0	0	2	0	2	4	25	25	50
8	19HSS171A	Essential English	HSS	Mandatory Course			0	0	2	25	25	50
Total								**19**	**26**	**325**	**325**	**650**

II SEMESTER- CHEMISTRY CYCLE													
Sl. No	**Course Code**	**Course**	**BOS**	**Credit Distribution**				**Overall Credits**	**Contact Hours**	**Marks**			
				L	**T**	**P**	**S**			**CIE**	**CEE**	**SEE**	**Total**
1	19MAT21A	Applied Mathematics-II	BS	2	1	0	0	3	4	50	50	50	100
2	19CHE22A	Engineering Chemistry	BS	3	0	0	0	3	3	50	50	50	100
3	19CSE23A	Introduction to Programming with C	CSE	3	0	0	0	3	3	50	50	50	100
4	19MEE24A	Computer Aided Engineering Drawing	ME	1	0	2	0	3	5	50	50	50	100
5	19ECE25A	Basic Electronics	ECE	3	0	0	0	3	3	50	50	50	100
6	19CHL27A	Engineering Chemistry Lab	BS	0	0	2	0	2	4	25	25	25	50
7	19CSL28A	Programming with C Lab	CSE	0	0	2	0	2	4	25	25	25	50
8	19HSS271A	Professional Communication	HSS	2	0	0	0	2	2	25	25	25	50
9	19HSS272A	Constitution of India and Professional Ethics	HSS	Mandatory Course			0	0	2	25	25	25	50
Total								**21**	**30**	**350**	**350**	**350**	**700**

THIRD SEMESTER-SCHEME

S. No	Course Code	Course	BOS	Credit Distribution				Overall Credits	Contact Hours	Marks		
				L	T	P	S			CIE	SEE	Total
1	20AIM31A	Applied Mathematics-III	BS	2	1	0	0	3	4	50	50	100
2	20HSS324 /20HSS325	Aadalitha Kannada / Vyavaharika Kannada	HSS	1	0	0	0	1	2	25	25	50
3	20HSS321A	Economics for Engineers	HSS	2	0	0	0	2	2	25	25	50
4	20AIM33A	Digital Electronics	AI&ML	3	0	0	0	3	3	50	50	100
5	20AIM34A	Data Structures using C	AI&ML	3	0	0	0	3	3	50	50	100
6	20AIM35A	Python Programming	AI&ML	3	0	0	0	3	3	50	50	100
7	20AIL36A	Digital Electronics Lab	AI&ML	0	0	2	0	2	4	25	25	50
8	20AIL37A	Data Structures using C Lab	AI&ML	0	0	2	0	2	4	25	25	50
9	20AIL38A	Python Programming Lab	AI&ML	0	0	2	0	2	4	25	25	50
10	20AIM39A	Mini Project - I	AI&ML	0	0	2	0	2	0	25	25	50
11	20DMAT31A*	Basic Applied Mathematics-1	BS	0	0	0	0	0	2	25	25	50
12	19HSS171*	Essential English	BS	0	0	0	0	0	2	25	25	50
Total								**23**	**29 /33***	**350/ 400***	**350/ 400***	**700/ 800***

*For Lateral Entry Students Only

FOURTH SEMESTER-SCHEME												
S. No	Course Code	Course	BOS	Credit Distribution				Overall Credits	Contact Hours	Marks		
				L	T	P	S			CIE	SEE	Total
1	20AIM41A	Mathematical Statistics	BS	2	1	0	0	3	4	50	50	100
2	20HSS422A	Life skills for Engineers	HSS	3	0	0	0	3	3	50	50	100
3	20HSS423A	Environmental Science and Awareness	HSS	Mandatory Course				0	2	25	25	50
4	20AIM43A	Introduction to Data Science	AI&ML	3	0	0	0	3	3	50	50	100
5	20AIM44A	Object Oriented Programming with Java	AI&ML	3	0	0	0	3	3	50	50	100
6	20AIM45A	Database Management System	AI&ML	3	0	0	0	3	3	50	50	100
7	20AIL46A	Object Oriented Programming with Java Lab	AI&ML	0	0	2	0	2	4	25	25	50
8	20AIL47A	Database Management System Lab	AI&ML	0	0	2	0	2	4	25	25	50
9	20AIM48A	Mini Project - II	AI&ML	0	0	2	0	2	0	25	25	50
10	20DMAT41A*	Basic Applied Mathematics-2	BS	0	0	0	0	0	2	25	25	50
11	19HSS272*	Constitution of India & Professional Ethics	BS	0	0	0	0	0	2	25	25	50
	Total							**21**	**26/ 30***	**350/ 400***	**350/ 400***	**700/ 800***

*For Lateral Entry Students Only

V SEMESTER												
S.No	Course Code	Course	BOS	Credit Distribution				Overall Credits	Contact Hours	Marks		
				L	T	P	S			CIE	SEE	Total
1	20AIM51A	Machine Learning	AI&ML	3	0	0	0	3	4	50	50	100
2	20AIM52A	Operating system	AI&ML	3	0	0	0	3	4	50	50	100
3	20AIM53A	Big data Technologies	AI&ML	3	0	0	0	3	4	50	50	100
4	20AIM54XA	Professional Elective - I	AI&ML	3	0	0	0	3	4	50	50	100
5	20AIM55XA	Professional Elective - II	AI&ML	3	0	0	0	3	4	50	50	100
6	20AIM56A	Design and Analysis of Algorithm	AI&ML	3	0	0	0	3	4	50	50	100
7	20AIL57A	Machine Learning Laboratory	AI&ML	0	0	2	0	2	4	25	25	50
8	20AIL58A	Design and Analysis of Algorithm Laboratory	AI&ML	0	0	2	0	2	4	25	25	50
9	20AIM59A	Mini Project - III	AI&ML	0	0	2	0	2	2	25	25	50
Total								**24**	**34**	**375**	**375**	**750**

S. NO	COURSE CODE	PROFESSIONAL ELECTIVE-1	S. NO	COURSE CODE	PROFESSIONAL ELECTIVE-2
1	20AIM541A	Information Storage and Retrieval	1	20AIM551A	Speech Synthesis and Recognition
2	20AIM542A	Introduction to sensor and IOT	2	20AIM552A	Embedded Systems
3	20AIM543A	Theory of Computation	3	20AIM553A	Software Engineering
4	20AIM544A	Parallel Processing	4	20AIM554A	Cryptography and Network Security

VI SEMESTER												
S.No	Course Code	Course	BOS	Credit Distribution				Overall Credits	Contact Hours	Marks		
				L	T	P	S			CIE	SEE	Total
1	20AIM61A	Deep Learning Techniques	AI&ML	3	0	0	0	3	4	50	50	100
2	20AIM62A	Data Visualization	AI&ML	3	0	0	0	3	4	50	50	100
3	20AIM63A	Artificial Intelligence	AI&ML	3	0	0	0	3	4	50	50	100
4	20NHOPXX	Open Elective - I	AI&ML	2	0	1	0	3	4	50	50	100
5	20AIM64XA	Professional Elective - III	AI&ML	3	0	0	0	3	4	50	50	100
6	20AIM65XA	Professional Elective - IV	AI&ML	3	0	0	0	3	4	50	50	100
7	20AIL66A	Deep Learning Laboratory	AI&ML	0	0	2	0	2	4	25	25	50
8	20AIL67A	Data Visualization Laboratory	AI&ML	0	0	2	0	2	4	25	25	50
9	20AIM68A	Mini Project - IV	AI&ML	0	0	2	0	2	2	25	25	50
Total								**24**	**34**	**375**	**375**	**750**

	Professional Elective - III	Open Elective - I	
Course Code	Course	Course Code	Course
20AIM641A	Biometrics	NHOP01	Big Data Analytics using HP Vertica-1
20AIM642A	Soft Computing	NHOP02	VM Ware Virtualization Essentials-1
20AIM643A	Complier Design	NHOP04	Big Data Analytics using HP Vertica-2
20AIM644A	Computer Networks	NHOP05	VM Ware Virtualization Essentials-2

Professional Elective - IV		NHOP07	SAP
20AIM651A	Augmented & Virtual Reality	NHOP08	Schneider-Industrial Automation
20AIM652A	Pattern Recognition & Image Processing	NHOP09	Cisco-Routing and Switching-1
20AIM653A	Advanced Java	NHOP10	Data Analytics
20AIM654A	Block chain Technologies	NHOP12	CISCO-Routing and switching-2
		NHOP13	IIOT Embedded Systems
		NHOP14	Block chain
		NHOP15	Product Life Cycle Management

VII SEMESTER												
S. No	Course Code	Course	BOS	Credit Distribution				Overall Credits	Contact Hours	Marks		
				L	T	P	S			CIE	SEE	Total
1	XXAIM71A	Cloud Computing	AI&ML	3	0	0	0	3	4	50	50	100
2	XXAIM72A	Web Technology	AI&ML	3	0	0	0	3	4	50	50	100
3	XXNHOPXX	Open Elective - II	AI&ML	2	0	1	0	3	4	50	50	100
4	XXAIM73X	Professional Elective - V	AI&ML	3	0	0	0	3	4	50	50	100
5	XXAIM74X	Professional Elective - VI	AI&ML	3	0	0	0	3	4	50	50	100
6	XXAIM75A	Natural Language processing	AI&ML	3	0	0	0	3	4	50	50	100
7	XXAIL76A	Cloud Computing Laboratory	AI&ML	0	0	2	0	2	4	25	25	50
8	XXAIL77A	Web Technology Lab	AI&ML	0	0	2	0	2	4	25	25	50
9	XXAIM78A	Project Phase – I	AI&ML	0	0	2	0	2	0	25	25	50
Total								**24**	**32**	**375**	**375**	**750**

Professional Elective – V		Open Elective - II	
Course Code	**Course**	**Course Code**	**Course**
XXAIM731A	Recommender System	NHOP01	Big Data Analytics using HP Vertica-1
XXAIM732A	Streaming Analytics	NHOP02	VM Ware Virtualization Essentials-1
XXAIM733A	Information Security	NHOP04	Big Data Analytics using HP Vertica-2
XXAIM734A	Human Computer Interaction	NHOP05	VM Ware Virtualization Essentials-2

Professional Elective – VI		NHOP07	SAP
XXAIM741A	Grid Computing	NHOP08	Schneider-Industrial Automation
XXAIM742A	Software Testing	NHOP09	Cisco-Routing and Switching-1
XXAIM743A	Social Network Analysis	NHOP10	Data Analytics
XXAIM744A	Cyber Security, Forensics and Law	NHOP12	CISCO-Routing and switching-2
		NHOP13	IIOT Embedded Systems
		NHOP14	Block chain
		NHOP15	Product Life Cycle Management

VIII SEMESTER												
S.No	Course Code	Course	BOS	Credit Distribution				Overall Credits	Contact Hours	Marks		
				L	T	P	S			CIE	SEE	Total
1	XXAIM81A	Reinforcement learning	AI&ML	3	0	0	0	3	4	50	50	100
2	XXAIM82A	Internship Viva	AI&ML	0	0	4	0	4	0	50	50	100
3	XXAIM83A	Project Phase - II	AI&ML	0	0	12	0	12	0	100	100	200
Total								**19**	**04**	**200**	**200**	**400**

V SEMESTER												
S.No	Course Code	Cour se	BOS	Credit Distribution				Overall Credits	Contact Hours	Marks		
				L	T	P	S			CIE	SEE	Total
1	20AIM51A	Machine Learning	AI&ML	3	0	0	0	3	4	50	50	100
2	20AIM52A	Operating system	AI&ML	3	0	0	0	3	4	50	50	100
3	20AIM53A	Big data Technologies	AI&ML	3	0	0	0	3	4	50	50	100
4	20AIM54XA	Professional Elective - I	AI&ML	3	0	0	0	3	4	50	50	100
5	20AIM55XA	Professional Elective - II	AI&ML	3	0	0	0	3	4	50	50	100
6	20AIM56A	Design and Analysis ofAlgorithm	AI&ML	3	0	0	0	3	4	50	50	100
7	20AIL57A	Machine Learning Laboratory	AI&ML	0	0	2	0	2	4	25	25	50
8	20AIL58A	Design and Analysis ofAlgorithm Laboratory	AI&ML	0	0	2	0	2	4	25	25	50
9	20AIM59A	Mini Project -III	AI&ML	0	0	2	0	2	2	25	25	50
Total								**24**	**34**	**375**	**375**	**750**

S. NO	COURSE CODE	PROFESSIONAL ELECTIVE-1	S. NO	COURSE CODE	PROFESSIONAL ELECTIVE-2
1	20AIM541A	Information Storage and Retrieval	1	20AIM551A	Speech Synthesis and Recognition
2	20AIM542A	Introduction to sensor and IOT	2	20AIM552A	Embedded Systems
3	20AIM543A	Theory of Computation	3	20AIM553A	Software Engineering
4	20AIM544A	Parallel Processing	4	20AIM554A	Cryptography and Network Security

MACHINE LEARNING

Course Code	**: 20AIM51A**	**Credits:**	**3**
L: T: P: S:	**: 3: 0: 0: 0:**	**CIE Marks:**	**50**
Exam Hours:	**: 3**	**SEE Marks:**	**50**

Course Outcomes:	**At the end of the Course, the Student will be able to:**
CO#	**COURSE OUTCOME (Student will be able to)**
20AIM51A.1	Apply the basic principles of Machine learning
20AIM51A.2	Analyze and formulate the Machine Learning concepts
20AIM51A.3	Design a model using supervised/unsupervised machine learning algorithms for classification/prediction/clustering
20AIM51A.4	Evaluate performance of various machine learning algorithms on various data sets of a domain.
20AIM51A.5	Use python/R for implementing machine learning algorithms to solve a given problem.

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM51A.1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
20AIM51A.2	-	3	-	-	3	-	-	-	-	-	-	-	3	2
20AIM51A.3	-	-	3	-	-	-	-	-	-	-	-	-	3	3
20AIM51A.4	-	-	-	3	3	-	-	-	-	-	-	-	3	3
20AIM51A.5	-	-	-	-	3	-	-	-	-	-	-	-	3	3
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)														

Module No	**Module Contents**	**Hours**	**COs**
1	**Introduction:** Terminologies in machine learning, Applications, Types of machine learning: supervised, unsupervised, semi-supervised learning, Reinforcement Learning. Features: Types of Data (Qualitative and Quantitative), Scales of Measurement (Nominal, Ordinal, Interval, Ratio), Concept of Feature, Feature construction, Feature Selection and Transformation, Curse of Dimensionality. Linear discriminant Analysis (LDA).	**9**	**CO1 CO3**
2	**Supervised Learning I:** Binary Classification: Linear Classification model, Performance Evaluation- Confusion Matrix, Accuracy, Precision, Recall, ROC Curves, F-Measure. Support Vector Machines- Large margin classifiers, Nonlinear SVM, kernel Functions. Multi-class Classification: Model, Performance Evaluation Metrics – Multiclass Classification techniques -One vs. One, One vs. Rest	**9**	**CO1 CO2 CO3 CO5**
3	**Supervised Learning II:** Decision Trees: Concepts and Terminologies, Classification and Regression Tree (CART) Regression: Introduction, Univariate Regression – Least-Square Method, Model Representation, Cost Functions: MSE, MAE, R-Square, Performance Evaluation, Estimating the values of the	**9**	**CO2, CO3 CO5**

	regression coefficients. Multivariate Regression: Model Representation. Naïve Bayes Classifier. K-Nearest Neighbour for Classification. Over fitting and Under fitting, Bias and Variance		
4	**Unsupervised learning :** Distance Based Models: Distance Metrics (Euclidean, Manhattan, Hamming, Minkowski Distance Metric), Clustering as Learning task: K-means clustering Algorithm-with example, k-medoid algorithm-with example. Principal Component analysis (PCA).	**9**	**CO3, CO4** **CO5**
5	**Reinforcement learning:** Learning from rewards – passive reinforcement learning – active reinforcement learning – generalization in reinforcement learning – policy search – inverse reinforcement learning – application Learning Task, Q-learning, Value function approximation, Temporal difference learning	**9**	**CO3** **CO5**

Text Books:

1. Tom Mitchell, "Machine Learning", McGraw Hill, 1997
2. E. Alpaydin, "Introduction to Machine Learning", PHI, 2005.

Reference Books:

1. AurolienGeron, "Hands-On Machine Learning with Scikit-Learn and TensorFlow, Shroff/O'Reilly",2017
2. ndreas Muller and Sarah Guido, "Introduction to Machine Learning with Python: A Guidefor Data Scientists", Shroff/O'Reilly, 2016

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	**Tests (25 marks)**	**Assignment 1 (7.5 Marks)**	**Assignment 2 (7.5Marks)**	**Quiz1 (05Marks)**	**Quiz2 (05 Marks)**
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	2.5	-	-	-	-
Evaluate	2.5	-	-	-	-
Create	-	-	-	-	-

SEE- Semester End Examination (50Marks)

Bloom's Category	**Questions (50 marks)**
Remember	10
Understand	10
Apply	20
Analyze	5
Evaluate	5
Create	-

OPERATING SYSTEM

Course Code	**: 20AIM52A**	**Credits:**	**3**
L: T: P: S:	**: 3: 0: 0: 0:**	**CIE Marks:**	**50**
Exam Hours:	**: 3**	**SEE Marks:**	**50**

Course Outcomes:	**At the end of the Course, the Student will be able to:**
CO#	**COURSE OUTCOME**
20AIM52A.1	Apply the functions of traditional and modern operating systems
20AIM52A.2	Analyze the concept of process and its management which includes process scheduling algorithms.
20AIM52A.3	Evaluate the problems related to concurrency, different synchronization mechanisms and deadlock handling.
20AIM52A.4	Compare and contrast various memory management techniques.
20AIM52A.5	Evaluate the various file implementation techniques.

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM52A.1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
20AIM52A.2	-	3	-	-	-	-	-	-	-	-	-	-	3	3
20AIM52A.3	-	3	3	-	-	-	-	-	-	-	-	-	3	3
20AIM52A.4	-	-	-	3	-	-	-	-	-	-	-	-	3	3
20AIM52A.5	-	-	3	-	-	-	-	-	-	-	-	-	3	3
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)														

Module No	**Module Contents**	**Hours**	**Cos**
1	**Introduction and Operating SystemServices:** Basics of Operating Systems: Definition - Operating System structure; Operating System operations – Dual-Mode and Multi-Mode; Kernel Data Structure – Lists, Stacks, and Queues, Trees; Computing Environments – Mobile Computing, Distributed Systems, Client-Server Computing, Peer-to-Peer, Virtualization, Cloud Computing, Real-Time Embedded Systems. Operating System Services; System Calls; Types of System Calls; Operating System Design and Implementation – Design Goals – Mechanisms and Policies – Implementation; Operating System structure – Layered Structure –Microkernels, Modules, Hybrid Systems – Mac OS X, iOS, Android.	**9**	**CO1 CO2**
2	**Process Management:** **Process:** Process Concept – The Processes, Process States, PCB; Process Scheduling – Scheduling Queues, Schedulers, Context Switch; Operation; Operation on Process; Inter-Process Communication – Shared-Memory System, Message Passing System. **CPU Scheduling:** Basic Concepts, CPU-I/O Burst Cycle; CPU Scheduler – Pre- emptive Scheduling, Dispatcher; Scheduling Criteria; Scheduling Algorithms – FCFS Scheduling, SJF Scheduling, Round-Robin Scheduling, Priority Scheduling	**9**	**CO2 CO3**
	Process Synchronization: Background; The Critical Section Problem; Peterson's Solution; Synchronization Hardware; Mutex		

3	Locks; Semaphores –Semaphore Usage, Semaphore Implementation, Deadlock and Starvation. Classical Problems of Synchronization – The Reader-Writer Problem, Dining-Philosopher Problem. **Deadlocks:** System Model; Deadlock Characterization – Necessary Conditions, Resource-Allocation Graph; Methods for Handling Deadlocks; Deadlock Prevention; Deadlock Avoidance; Deadlock Detection and Recovery.	**10**	**CO3**
4	**Memory Management:** **Main Memory:** Background; Swapping; Contiguous Memory Allocation – Memory Protection, Memory Allocation, Fragmentation; Paging – Basic Method, Hardware Support, Protection; Structure of Page Table – Hierarchical Paging, Hash-Page Table; Segmentation – Basic Method, Segmentation Hardware. **Virtual Memory:** Background; Demand Paging; Page Replacement – Basic Page Replacement – FIFO Page Replacement, Optimal Page Replacement, LRU Page Replacement; Allocation of Frames – Minimum Number of Frames, Allocation Algorithms, Global Vs Local; Thrashing – Causes of Thrashing	**9**	**CO3** **CO4**
5	**File System Interface and Implementation:** **File-System Interface:** File Structure; Access methods – Sequential Access, Direct Access, Other Access Methods **Implementation:** Overview, Partitions and Mounting, Directory Implementation – Linear List, Hash Table; Allocation Methods – Contiguous Allocation, Linked Allocation, Indexed Allocation, Free Space Management – Bit-Vector, Linked List, Grouping, Counting. **Mass Storage Structures:** Overview; Disk Structure; Disk Scheduling – FCFS, SSTF, SCAN Scheduling, CSCAN Scheduling, LOOK Scheduling, Selection of Disk Scheduling Algorithm.	**8**	**CO4** **CO5**

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, John Wiley & Sons, Inc., 9th Edition, 2012, ISBN 9781118063330.

Reference Books:

1. William Stallings, “Operating Systems: Internals and Design Principles”, Eighth Edition, Prentice Hall, 2015.

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests (25 marks)	Assignment 1 (7.5 Marks)	Assignment 2 (7.5Marks)	Quiz1 (05Marks)	Quiz2 (05 Marks)
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	2.5	-	-	-	-
Evaluate	2.5	-	-	-	-
Create	-	-	-	-	-

SEE- Semester End Examination (50Marks)

Bloom's Category	Tests
Remember	10
Understand	20
Apply	20
Analyze	-
Evaluate	-
Create	-

BIG DATA TECHNOLOGIES

Course Code	**: 20AIM53A**	**Credits**	**: 3**
L: T: P: S:	**: 3: 0: 0: 0:**	**CIE Marks:**	**50**
Exam Hours:	**: 3**	**SEE Marks:**	**50**

Course Outcomes:	**At the end of the Course, the Student will be able to:**
CO#	**COURSE OUTCOME**
20AIM53A.1	Apply the Big Data concepts and identify its Business Implications.
20AIM53A.2	Analyze the components of Hadoop and Hadoop Eco-System
20AIM53A.3	Design and Process Data on Distributed File System
20AIM53A.4	Manage Job Execution in Hadoop Environment
20AIM53A.5	Develop Big Data Solutions using Hadoop Eco System

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM53A.1	3	-	-	-	-	-	-	-	-	-	-	3	-	-
20AIM53A.2	-	3	-	-	-	-	-	-	-	-	-	3	3	3
20AIM53A.3	-	3	3	-	-	-	-	-	-	-	-	3	3	3
20AIM53A.4	-	-	-	3	-	-	-	-	-	-	-	3	3	3
20AIM53A.5	-	-	-	3	3	-	-	-	-	-	-	3	3	3
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)														

Module No	**Module Contents**	**Hours**	**COs**
1	INTRODUCTION TO BIG DATA AND HADOOP Types of Digital Data, Introduction to Big Data, Big Data Analytics, History of Hadoop, Apache Hadoop, Analysing Data with Unix tools, Analysing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data Strategy, Introduction to Infosphere BigInsights and Big Sheets.	**9**	**CO1 CO2**
2	HDFS(Hadoop Distributed File System) The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures.	**9**	**CO2 CO3**
3	Map Reduce Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.	**9**	**CO3 CO3**
4	Hadoop Eco System Pig : Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators.	**9**	**CO4 CO2**
5	Hive : Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions. Hbase : HBasics, Concepts, Clients, Example, Hbase Versus RDBMS. Introduction to Big SQL.	**9**	**CO4 CO5**

Text Books:

1. Tom White " Hadoop: The Definitive Guide" Third Edit on, O'reily Media, 2012
2. Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015.

Reference Books:

1. Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRC press (2013)
2. Paul Zikopoulos ,Dirk DeRoos , Krishnan Parasuraman , Thomas Deutsch , James Giles , David Corigan , "Harness the Power of Big Data The IBM Big Data Platform ", Tata McGraw Hill Publications, 2012.

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests (25 marks)	Assignment 1 (7.5 Marks)	Assignment 2 (7.5Marks)	Quiz1 (05Marks)	Quiz2 (05 Marks)
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	2.5	-	-	-	-
Evaluate	2.5	-	-	-	-
Create	-	-	-	-	-

SEE- Semester End Examination (50Marks)

Bloom's Category	Tests
Remember	10
Understand	20
Apply	20
Analyze	-
Evaluate	-
Create	-

DESIGN AND ANALYSIS OF ALGORITHM

Course Code	**: 20AIM56A**	**Credits:**	**3**
L: T: P: S:	**: 3: 0: 0: 0:**	**CIE Marks:**	**50**
Exam Hours:	**: 3**	**SEE Marks:**	**50**

Course Outcomes:	**At the end of the Course, the Student will be able to:**
CO#	**COURSE OUTCOME**
20AIM56A.1	Apply the algorithms to solve complex problems by determining various design techniques
20AIM56A.2	Identify appropriate algorithms to assess and formulate solution
20AIM56A.3	Design a strategy to solve graph and knapsack Problems
20AIM56A.4	Develop a design technique to solve searching and sorting problems
20AIM56A.5	Apply backtracking and branch &bound technique to assess an algorithm and formulate Solution

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM56A.1	3	3	-	-	-	-	-	-	-	-	-	-	3	3
20AIM56A.2	-	3	-	-	-	-	-	-	-	-	-	-	3	3
20AIM56A.3	-	-	3	-	-	-	-	-	-	-	-	-	3	3
20AIM56A.4	-	-	3	3	-	-	-	-	-	-	-	-	3	3
20AIM56A.5	-	-	-	-	3	-	-	-	-	-	-	-	3	3
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)														

Module No	**Module Contents**	**Hours**	**COs**
1	**INTRODUCTION TO ALGORITHMS & GROWTH OF FUNCTIONS** Introduction to Algorithms, Role of algorithms in computing, Fundamentals of Algorithmic problem solving, Fundamentals of Analysis of Algorithms, Analysis Framework, Asymptotic notations, Standard notations and common functions, Important problem types – Searching, sorting, string processing, graph problems.	**9**	**CO1**
2	**DIVIDE & CONQUER:** General method, Binary search, Recurrence equation for divide and conquer, Finding the maximum and minimum ,Merge sort, Quick sort , Strassen's matrix multiplication, Advantages and Disadvantages of divide and conquer.	**9**	**CO2**
3	**GREEDY METHOD & DYNAMIC PROGRAMMING** **GREEDY METHOD:** Introduction, Job scheduling problem, Minimum Spanning tree algorithms – Kruskals & Prims, Shortest Path algorithm – Dijkstra's,	**9**	**CO3**
	Huffman Trees, Knapsack problems, Travelling Salesman problem **DYNAMIC PROGRAMMING:** Introduction, Computing Binomial Coefficients, Transitive closure - Warshall's and Floyds algorithm		

4	**DECREASE & CONQUER, TRANSFORM & CONQUER** **DECREASE & CONQUER:** Introduction – Decrease by constant, decrease by constant factor, variable size decrease, Breadth First search traversal, Depth First search traversal, Topological sorting **TRANSFORM & CONQUER:** Introduction, Balanced Search trees – AVL trees & 2-3 trees, Red Black Trees	**9**	**CO4**
5	**Backtracking , Branch and Bound** **BACKTRACKING:** Introduction, N Queens problem, subset sum problem, **BRANCH & BOUND:** Introduction, Travelling Salesman problem, Knapsack problem, Assignment problem , NP-Complete and NP-Hard problems: Basic concepts, non- deterministic algorithms, P, NP, NP-Complete problems.	**9**	**CO5**

Text Books:

1. Anany Levitin, "Introduction to theDesign & Analysis of Algorithms", SECOND Edition, PEARSON Education

Reference Books:

1. Thomas H Cormen, Charles E Leiserson, Ronald R Rivest& Clifford Stein, "Introduction to Algorithms", THIRD Edition, Eastern Economy Edition

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests (25 marks)	Assignment 1 (7.5 Marks)	Assignment 2 (7.5Marks)	Quiz1 (05Marks)	Quiz2 (05 Marks)
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	2.5	-	-	-	-
Evaluate	2.5	-	-	-	-
Create	-	-	-	-	-

SEE- Semester End Examination (50Marks)

Bloom's Category	Tests
Remember	10
Understand	20
Apply	20
Analyze	-
Evaluate	-
Create	-

MACHINE LEARNING LABORATORY

Course Code	**: 20AIL57A**	**Credits :**	**2**
L: T: P: S:	**: 0: 0: 2: 0:**	**CIE Marks:**	**25**
Exam Hours:	**: 3**	**SEE Marks:**	**25**

Course Outcomes:	**At the end of the Course, the Student will be able to**
CO#	COURSE OUTCOME
20AIL57A.1	Understand the implementation of procedures for machine learning algorithms.
20AIL57A.2	Design Java/Python programs for various Learning algorithms.
20AIL57A.3	Analyze and apply the appropriate data sets for Machine Learning algorithms.
20AIL57A.4	Identify and apply Machine Learning algorithms to solve real world problems.

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIL57A.1	3	-	-	-	-	-	-	-	-	-	-	3	3	2
20AIL57A.2	-	3	-	-	-	-	-	-	-	-	-	3	3	2
20AIL57A.3	-	-	-	-	3	-	-	-	-	-	-	3	3	2
20AIL57A.4	-	-	-	3	3	-	-	-	-	-	-	3	3	2
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)														

Ex. No	Experiments	Hours	COs
1.	Implement and demonstrate the Linear discriminant Analysis (LDA).	**4**	**CO1, CO2, CO3, CO4**
2.	Develop a Support Vector Machine model considering a Sample Dataset and evaluate the model.	**4**	**CO1, CO2, CO3, CO4**
3.	Write a program to demonstrate the working of the decision tree Based CART algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new Sample.	**4**	**CO1, CO2, CO3, CO4**
4.	Develop a simple regression model for the given dataset and evaluate its performance.	**4**	**CO1, CO2, CO3, CO4**
5.	Apply multivariate regression model using suitable library function to make necessary predictions.	**4**	**CO1, CO2, CO3, CO4**
6.	Implement a program in python to illustrate the Bias Variance Trade-off in a machine learning model	**4**	**CO1, CO2, CO3, CO4**
7.	Apply k-means algorithm to generate clusters for the given dataset and evaluate its performance.		
8.	Implement and demonstrate the Principal Component analysis (PCA)	**4**	**CO1, CO2, CO3, CO4**

9.	Implement Reinforcement learning with suitable example.	**4**	**CO1, CO2, CO3, CO4**
10.	Implement text classification model using suitable algorithm.	**4**	**CO1, CO2, CO3, CO4**

Text Books:

1. Tom Mitchell, "Machine Learning", McGraw Hill, 1997
2. E. Alpaydin, "Introduction to Machine Learning", PHI, 2005.

Reference Books:

1. AurolienGeron, "Hands-On Machine Learning with Scikit-Learn and TensorFlow, Shroff/O'Reilly",2017
2. ndreas Muller and Sarah Guido, "Introduction to Machine Learning with Python: A Guidefor Data Scientists", Shroff/O'Reilly, 2016

CIE- Continuous Internal Evaluation (25 Marks)

Bloom's Category	Review (25marks)
Remember	-
Understand	-
Apply	10
Analyze	10
Evaluate	5
Create	-

SEE- Semester End Examination (25Marks)

Bloom's Category	Review (25marks)
Remember	-
Understand	-
Apply	10
Analyze	10
Evaluate	5
Create	-

DESIGN AND ANALYSIS OF ALGORITHM LABORATORY

Course Code	**: 20AIL58A**	**Credits:**	**2**
L: T: P: S:	**: 0: 0: 2: 0:**	**CIE Marks:**	**25**
Exam Hours:	**: 3**	**SEE Marks:**	**25**

Course Outcomes:	**At the end of the Course, the Student will be able to**
CO#	COURSE OUTCOME
20AIL58A.1	Analyze the complexities of various applications in different domains
20AIL58A.2	Implement efficient algorithms to solve problems in various domains
20AIL58A.3	Use suitable design technique to develop efficient algorithms
20AIL58A.4	Compare, implement and understand when to apply various design techniques

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIL58A.1	3	-	-	-	-	-	-	-	-	-	-	3	3	2
20AIL58A.2	-	3	3	3	-	-	-	-	-	-	-	3	3	2
20AIL58A.3	-	-	-	3	3	-	-	-	-	-	-	3	3	2
20AIL58A.4	-	-	-	3	3	-	-	-	-	-	-	3	3	2
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)														

Exp. No	**Experiment**	**Hours**	**CO**
1	Write a program to find GCD of two numbers using differential Algorithms	**4**	**CO1**
2	Write a program to implement string matching using Brute force	**4**	**CO1**
3	Write a program to implement Merge Sort	**4**	**CO2, CO3**
4	Write a program to implement Quick Sort	**4**	**CO2, CO3**
5	Write a program to obtain minimum cost spanning tree using Prim's Algorithm	**4**	**CO2, CO3**
6	Write a program to obtain minimum cost spanning tree using Kruskal's Algorithm	**4**	**CO2, CO3**
7	Write a program to obtain shortest path using Djikstra's algorithm	**4**	**CO2, CO3**
8	Write a program to obtain shortest path using Floyds algorithms	**4**	**CO2, CO3**
9	Write a program to compute Transitive closure using Warshall's Algorithm	**4**	**CO2, CO3**
10	Write a program to implement Topological sorting	**4**	**CO2, CO3**
11	Write a program to implement Subset Sum problem using Backtracking	**4**	**CO4**
12	Write a program to implement N Queens problem using Backtracking	**4**	**CO4**

Text Book:

1. Anany Levitin, "Introduction totheDesign & Analysis of Algorithms", SECOND Edition, PEARSON Education

Reference Book:

1. Thomas H Cormen, Charles E Leiserson, Ronald R Rivest& Clifford Stein, "Introduction to Algorithms", THIRD Edition, Eastern Economy Edition

CIE- Continuous Internal Evaluation (25 Marks)

Bloom's Category	Review (25marks)
Remember	-
Understand	-
Apply	10
Analyze	10
Evaluate	5
Create	-

SEE- Semester End Examination (25Marks)

Bloom's Category	Review (25marks)
Remember	-
Understand	-
Apply	10
Analyze	10
Evaluate	5
Create	-

MINI PROJECT -III

Course Code	**: 20AIM59A**	**Credits:**	**2**
L: T: P: S:	**: 0: 0: 2: 0:**	**CIE Marks:**	**25**
Exam Hours:	**: 3**	**SEE Marks:**	**25**

Course Outcomes:	**At the end of the Course, the Student will be able to**
CO#	COURSE OUTCOME
20AIM59.1	Understand the technological needs and/ or societal needs and sustainability of the environment
20AIM59.2	Design application using Big Data Technologies
20AIM59.3	Analyse and evaluate the outcome of the project
20AIM59.4	Develop,Test, validate and communicate the identified solutions in a structured way.

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM59.1	-	-	-	-	-	3	2	3	-	-	-	3	3	2
20AIM59.2	-	-	3	-	3	-	-	-	-	-	-	3	3	2
20AIM59.3	-	3	-	-	-	-	-	-	-	-	-	3	3	2
20AIM59.4	-	-	-	3	-	-	-	-	3	3	3	3	3	2
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)														

Each team capable of identifying a problem and carry out a mini project on the problem defined. A panel of experts will review the code developed towards the project during the course of the semester. Plagiarized projects will automatically get an **"F" GRADE** and the student will be liable for further disciplinary action. At the completion of a project, the team will submit a project report, which will be evaluate by duly appointed examiner(s).

CIE- Continuous Internal Evaluation (25 Marks)

Bloom's Category	**Review (25marks)**
Remember	-
Understand	-
Apply	10
Analyze	10
Evaluate	5
Create	-

SEE- Semester End Examination (25Marks)

Bloom's Category	**Review (25marks)**
Remember	-
Understand	-
Apply	10
Analyze	10
Evaluate	5
Create	-

INFORMATION STORAGE AND RETRIVEVAL

Course Code	**: 20AIM541A**	**Credits:**	**3**
L: T: P: S:	**: 3: 0: 0: 0:**	**CIE Marks:**	**50**
Exam Hours:	**: 3**	**SEE Marks:**	**50**

Course Outcomes:	**At the end of the Course, the Student will be able to:**
CO#	**COURSE OUTCOME**
20AIM541A.1	Understand and apply the concept of Information retrieval
20AIM541A.2	Analyze the storage and retrieval process of text and multimedia data.
20AIM541A.3	Evaluate the performance of any information retrieval system
20AIM541A.4	Know the importance of recommender system.
20AIM541A.5	Use modern tools for information retrieval in multimedia and distributed systems.

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM541A.1	3	-	-	-	-	-	-	-	-	-	-	3	3	3
20AIM541A.2	-	3	-	-	-	-	-	-	-	-	-	-	3	3
20AIM541A.3	-	-	3	3	-	-	-	-	-	-	-	-	3	3
20AIM541A.4	-	-	-	3	-	-	-	-	-	-	-	3	3	3
20AIM541A.5	-	-	-	-	3	-	-	-	-	-	-	3	3	3

Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)

Module No	Module Contents	Hours	COs
1	Basic Concepts of IR, Data Retrieval & Information Retrieval, text mining and IR relation, IR system block diagram. Automatic Text Analysis: Luhn's ideas, Conflation Algorithm, Indexing and Index Term Weighing, Probabilistic Indexing Inverted file, Suffix trees & suffix arrays, Signature Files, Scatter storage or hash addressing, Clustered files, Hypertext and XML data structures.	**9**	**CO1 CO2**
2	Retrieval strategies: Vector Space model, Probabilistic retrieval strategies, Language models, Inference networks, Extended boolean retrieval, Latent semantic indexing, neural networks, Fuzzy set retrieval Retrieval utilities: Relevance feedback, Cluster Hypothesis, Clustering Algorithms: Single Pass Algorithm, Single Link Algorithm.	**9**	**CO1 CO2**
3	Performance evaluation: Precision and recall, MRR, F-Score, NDCG, user oriented measures, cross fold evaluation. Visualisation in Information System: Starting points, document context, User relevance judgement Interface support for search process.	**9**	**CO3 CO4**
4	Distributed IR: Introduction, Collection Partitioning, Source Selection Query Processing, web issues. MULTIMEDIA IR: Introduction, Data Modeling, Query languages, Generic multimedia indexing approach, One dimensional time series, two dimensional color images, Automatic feature extraction	**9**	**CO4 CO3**
5	Searching the Web: Challenges, Characterizing the Web, Search Engines Browsing, Mata-searchers, Web crawlers, Meta-crawler, Web data mining Finding needle in the Haystack, Searching using Hyperlinks, Page ranking algorithms: Page rank, Rank SVM	**9**	**CO4 CO5**

Text Books:

1. David A. Grossman, Ophir Frieder, Information Retrieval – Algorithms and Heuristics, Springer,2nd Edition(Distributed by Universal Press), 2004

Reference Books:

1. Soumen Chakrabarti, Mining the Web: Discovering Knowledge from Hypertext Data, Morgan –Kaufmann Publishers, 2002.

2 Gerald J Kowalski, Mark T Maybury Information Storage and Retrieval Systems: Theory and Implementation, Springer, 2004.

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests (25 marks)	Assignment 1 (7.5 Marks)	Assignment 2 (7.5Marks)	Quiz1 (05Marks)	Quiz2 (05 Marks)
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	2.5	-	-	-	-
Evaluate	2.5	-	-	-	-
Create	-	-	-	-	-

SEE- Semester End Examination (50Marks)

Bloom's Category	Tests
Remember	10
Understand	20
Apply	20
Analyze	-
Evaluate	-
Create	-

INTRODUCTION TO SENSOR AND IOT

Course Code	**: 20AIM542A**	**Credits**	**: 3**
L: T: P: S:	**: 3: 0: 0: 0:**	**CIE Marks:**	**50**
Exam Hours:	**: 3**	**SEE Marks:**	**50**

Course Outcomes:	**At the end of the Course, the Student will be able to:**
CO#	**COURSE OUTCOME**
20AIM542A.1	Identify and apply various types of sensors used in IOT
20AIM542A.2	Analyze and display the connection of sensors to processing devices.
20AIM542A.3	Define and explain basic issues, policy and challenges in the IoT
20AIM542A.4	Illustrate Mechanism and Key Technologies in IoT
20AIM542A.5	Use the latest technologies that are Standards of the IoT

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM542A.1	3	-	-	-	-	-	-	-	-	-	-	-	3	3
20AIM542A.2	-	3	3	-	-	-	-	-	-	-	-	3	3	3
20AIM542A.3	-	-	3	-	-	-	-	-	-	-	-	-	-	3
20AIM542A.4	-	-	-	3	-	-	-	-	-	-	-	-	3	-
20AIM542A.5	-	-	-	3	3	-	-	-	-	-	-	3	3	-
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)														

Module No	**Module Contents**	**Hours**	**COs**
1	Introduction: What are sensors/transducers, Principles, Classification, Parameters, Environmental Parameters & Characteristics. Mechanical and Electromechanical Sensors: Introduction, Resistive Potentiometer, Strain gauge, Inductive Sensors, Capacitive Sensors, Force/Stress sensors, Ultrasonic Sensors.	**9**	**CO1 CO2**
2	Thermal Sensors: Introduction, Gas Thermometric Sensors, Thermal Expansion type thermometric sensors, Dielectric constant and refractive index thermo sensors, magnetic thermometer, resistance change type thermometric sensors, thermoemf sensors, thermal radiation sensors, Quartz crystal thermoelectric sensors, Spectroscopic thermometry, noise thermometry, heat flux sensors. Magnetic sensors: Introduction, Sensors and principles, magnetoresistive sensors, Hall effect sensors, inductive and eddy current sensors, Angular/Rotary movement sensors, Eddy current sensors, Electromagnetic flowmeter, SQUID sensors	**9**	**CO2 CO3**
3	Introduction to Internet of Things(IoT): What is The Internet of Things? Overview and Motivations, Examples of Applications, IPV6 Role, Areas of Development and Standardization, Scope of the Present Investigation. Internet of Things Definitions and frameworks:-IoT Definitions, IoT Frameworks, Basic Nodal Capabilities. Internet of Things Application Examples:-Overview, Smart Metering/Advanced Metering Infrastructure e-Health/Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards, Tracking, Over-The-Air-Passive Surveillance/Ring of Steel, Control Application Examples, Myriad	**9**	**CO2 CO3**

	Other Applications.		
4	Fundamental IoT Mechanism and Key Technologies:-Identification of IoT Object and Services, Structural Aspects of the IoT, Key IoT Technologies. Evolving IoT Standards:-Overview and Approaches, IETF IPV6 Routing Protocol for RPL Roll, Constrained Application Protocol Representational State Transfer, ETSI M2M,Third Generation Partnership Project Service Requirements for Machine-Type Communications, CENELEC, IETF IPv6 Over Low power WPAN, Zigbee IP(ZIP),IPSO.	**9**	**CO2 CO4**
5	Layer 12 Connectivity: Wireless Technologies for the IoT-WPAN Technologies for IoT/M2M, Cellular and Mobile Network Technologies for IoT/M2M. Layer 3 Connectivity :IPv6 Technologies for the IoT: Overview and Motivations. Address Capabilities,IPv6 Protocol Overview, IPv6 Tunneling, IPsec in IPv6,Header Compression Schemes, Quality of Service in IPv6, Migration Strategies to IPv6.	**9**	**CO4 CO5**

Text Books:

1. Patranabis D, "Sensors and Transducers," Prentice Hall of India,2004
2. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6:The Evolving World of M2M Communications", Wiley, 2013.
3. Arshdeep Bahga, Vijay Madisetti, "Internet of Things: A Hands on Approach" Universities Press., 2015

Reference Books:

1. Callaway EH, "Wireless Sensor Networks : Architecture and Protocols," Auerbach Publications
2. Michael Miller," The Internet of Things", First Edition, Pearson, 2015.

CI - Continuous Internal Evaluation (50 Marks)

Bloom's Category	**Tests (25 Marks)**	**Assignment 1 (7.5 Marks)**	**Assignment 2 (7.5Marks)**	**Quiz1 (05Marks)**	**Quiz2 (05 Marks)**
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	2.5	-	-	-	-
Evaluate	2.5	-	-	-	-
Create	-	-	-	-	-

SEE - Semester End Examination (50Marks)

Bloom's Category	**Questions (50 marks)**
Remember	10
Understand	10
Apply	20
Analyze	5
Evaluate	5
Create	-

THEORY OF COMPUTATION

Course Code	**: 20AIM543A**	**Credits**	**: 3**
L: T: P: S:	**: 3: 0: 0: 0:**	**CIE Marks:**	**50**
Exam Hours:	**: 3**	**SEE Marks:**	**50**

Course Outcomes:	**At the end of the Course, the Student will be able to:**
CO#	**COURSE OUTCOME**
20AIM543A.1	Apply and design a finite automaton to accept a set of strings of a language.
20AIM543A.2	Analyze and tell whether the given language is regular or not.
20AIM543A.3	Design context free grammars to generate strings of context free language
20AIM543A.4	Design push down automata and the equivalent context free grammars and Design Turing machine.
20AIM543A.5	Interpret the difference between computability and non-computability, Decidability and un-decidability.

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM543A.1	3	-	-	-	-	-	-	-	-	-	-	3	3	3
20AIM543A.2	-	3	2	-	-	-	-	-	-	-	-	3	3	3
20AIM543A.3	-	-	3	2	-	-	-	-	-	-	-	3	3	3
20AIM543A.4	-	-	-	3	3	-	-	-	-	-	-	3	3	3
20AIM543A.5	-	-	-	-	3	-	-	-	-	-	-	3	3	3
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)														

Module No	**Module Contents**	**Hours**	**COs**
1	The Theory Of Automata: Introduction to automata theory, Examples of automata machine, Finite automata as a language acceptor and translator, Deterministic finite automata. Non-deterministic finite automata, finite automata with output (Mealy Machine. Moore machine), Finite automata with ε moves, Minimizing number of states of a DFA, My hill Nerode theorem, Properties and limitation of FSM, Application of finite automata.	**9**	**CO1 CO2**
2	Regular Expressions: Alphabet, String and Languages, Regular expression Properties of Regular Expression, Finite automata and Regular expressions Arden's Theorem, Regular Expression to DFA conversion & vice versa Pumping lemma for regular sets, Application of pumping lemma, Regular sets and Regular grammar, Closure properties of regular sets. Decision algorithm for regular sets and regular grammar.	**9**	**CO2 CO1**
3	Grammars: Definition and types of grammar, Chomsky hierarchy of grammar, Relation between types of grammars, Context free grammar, Left most & right most derivation trees, Ambiguity in grammar, Simplification of context free grammar, Chomsky Normal From, Greibach Normal From, properties of context free language, Pumping lemma for context free language, Decision algorithm for context tree language.	**9**	**CO2 CO3**
4	Push Down Automata And Turing Machine:Basic definitions, Deterministic push down automata and non-deterministic push down automata, Acceptance of push down automata, Push down automata and context free language, Turing machine model, Representation of Turing Machine, Construction of	**9**	**CO3 CO4**

	Turing Machine for simple problem's, Universal Turing machine and other modifications .Church's Hypothesis, , Halting problem of Turing Machine		
5	Computability: Introduction and Basic concepts, Recursive function, Partial recursive function, Initial functions, Composition of functions, Ackerman's function, Recursively Enumerable and Recursive languages, Decidable and undecidable problem, Post correspondence problem, Space and time complexity.	**9**	**CO4 CO5**

Text Books:

1. Theory of Computer Science (Automata Language & Computation), K.L.P. Mishra and N. Chandrasekran, PHI.
2. Introduction to Automata theory. Language and Computation, John E. Hopcropt & Jeffery D. Ullman, Narosa, Publishing House.

Reference Books:

1. John Martin, "Introduction to Languages and the Theory of Computation", Tata McGraw Hill
2 Kamala Krithivasan, Rama R., "Introduction to Formal Languages Automata Theory and Computation", 2 nd Edition, Pearson Education.

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests (25 marks)	Assignment 1 (7.5 Marks)	Assignment 2 (7.5Marks)	Quiz1 (05Marks)	Quiz2 (05 Marks)
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	2.5	-	-	-	-
Evaluate	2.5	-	-	-	-
Create	-	-	-	-	-

SEE- Semester End Examination (50Marks)

Bloom's Category	Tests
Remember	10
Understand	20
Apply	20
Analyze	-
Evaluate	-
Create	-

PARALLEL PROCESSING

Course Code	**: 20AIM544A**	**Credits:**	**3**
L: T: P: S:	**: 3: 0: 0: 0:**	**CIE Marks:**	**50**
Exam Hours:	**: 3**	**SEE Marks:**	**50**

Course Outcomes:	**At the end of the Course, the Student will be able to:**
CO#	**COURSE OUTCOME**
20AIM544A.1	Understanding and apply the parallel computer architecture and different models for parallel computing
20AIM544A.2	To analyze the concepts related to memory consistency models, cache coherence, interconnection networks, and latency tolerating techniques.
20AIM544A.3	Develop structural intuition of how the hardware and the software work, starting from simple systems to complex shared resource architectures.
20AIM544A.4	Know the current practical implementations of parallel architectures.
20AIM544A.5	Using latest tools to design parallel programs and to evaluate their execution

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM544A.1	3	-	-	-	-	-	-	-	-	-	-	3	3	3
20AIM544A.2	-	3	-	-	--	-	-	-	-	-	-	3	3	3
20AIM544A.3	-	3	3	-	-	-	-	-	-	-	-	3	3	3
20AIM544A.4	-	-	-	3	-	-	-	-	-	-	-	3	3	3
20AIM544A.5	-	-	-	3	3	-	-	-	-	-	-	3	3	3

Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)

Module No	Module Contents	Hour	COs
1	Introduction & Technique of Parallelism: Trends towards parallel computing, parallelism in Uniprocessor systems, Architectural classification schemes, Amdahl's law, Moore's law, Principles of Scalable Performance, Parallel Processing in Memory, Parallel Algorithms, Parallel Algorithm Complexity, Models of Parallel Processing, Cache coherence, Cache coherence Protocols	**9**	**CO1 CO2**
2	Pipeline & Vector Processing: Conditions of Parallelism: Data & Resource dependencies, Programflow mechanisms: Control-flow .vs. Data flow computers Principle of pipelining and vector processing: principlesof linear pipelining, classification of pipeline processors. General pipelines and reservation tables. Instruction and arithmetic pipelines, vector processing architecture of Cray –1, Pipeline hazards, VLIW computers, ArrayProcessing.	**9**	**CO1 CO2**
3	Parallel Models & Mesh-Based Architectures: PRAM and Basic Algorithms, Data Broadcasting, Parallel Prefix Computation, Shared- Memory Algorithms, Parallel Selection Algorithm, Sorting and Selection Networks, Circuit-Level Examples, Tree-Structured Dictionary Machine, Sorting on a 2D Mesh or Torus, Routing on a 2D Mesh or Torus, Other Mesh-Related Architectures, Meshes of Trees, Low-Diameter Architectures, Hyper-cubes and Their Algorithms, The Cube Connected Cycles Network , Shuffle and Shuffle–Exchange Networks.	**9**	**CO2 CO3**

4	Multiprocessor architecture and Programming: Emulation and Schedulii Emulations among Architectures, Distributed Shared Memory, Data Stora Input, and Output, Multithreading and Latency Hiding, Parallel I/ Technology Defect-Level Methods, Fault-Level Methods, Error-Lev Methods, Paralle Programming Parallel Operating Systems, Parallel File Systems.	**9**	**CO3 CO4**
5	Parallel System Implementations: Shared-Memory MIMD Machine Variations in Shared Memory, MIN-Based BBN Butterfly, Vector-Paral Cray Y-MP, CC-NUMA Stanford DASH, Message-Passing MIMD Machines Data-Parallel SIMD Machines, Processor and Memory Technologies.	**9**	**CO3 CO5**

Text Books:

1. Computer Architecture & Parallel processing - Kai Hwang 7 Briggs.(MGH)
2. Parallel Computers: Arch.& Prog., Rajaraman & Siva Ram Murthy, PHI.

Reference Books:

1. Parallel Computer 2 –Arch..& Algo., Adam Hilger, R.W. Hockney, C.R. Jesshope,.
2 Parallel computing- Theory and practice - Michael J Quinn- Mc Graw Hill.

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests (25 marks)	Assignment 1 (7.5 Marks)	Assignment 2 (7.5Marks)	Quiz1 (05Marks)	Quiz2 (05 Marks)
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	2.5	-	-	-	-
Evaluate	2.5	-	-	-	-
Create	-	-	-	-	-

SEE- Semester End Examination (50Marks)

Bloom's Category	Tests
Remember	10
Understand	20
Apply	20
Analyze	-
Evaluate	-
Create	-

SPEECH SYNTHESIS AND RECOGNITION

Course Code	**: 20AIM551A**	**Credits:**	**3**
L: T: P: S:	**: 3: 0: 0: 0:**	**CIE Marks:**	**50**
Exam Hours:	**: 3**	**SEE Marks:**	**50**

Course Outcomes:	**At the end of the Course, the Student will be able to:**
CO#	**COURSE OUTCOME**
20AIM551A.1	Understand and apply the speech production and perception process
20AIM551A.2	Analyze speech signals in time and frequency domain.
20AIM551A.3	Design and implement algorithms for processing speech signals.
20AIM551A.4	Build a simple speech recognition/TTS system.
20AIM551A.5	Use latest multimedia tools for speech synthesis and processing

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM544A.1	3	-	-	-	-	-	-	-	-	-	-	3	3	3
20AIM544A.2	-	3	-	-	-	-	-	-	-	-	-	3	3	3
20AIM544A.3	-	-	3	-	-	-	-	-	-	-	-	3	3	3
20AIM544A.4	-	-	-	3	-	-	-	-	-	-	-	3	3	3
20AIM544A.5	-	-	-	3	3	-	-	-	-	-	-	3	3	3
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)														

Module No	**Module Contents**	**Hour**	**COs**
1	Basic Concepts: Speech Fundamentals: Articulatory Phonetics – Production and Classification of Speech Sounds; Acoustic Phonetics – acoustics of speech production; Review of Digital Signal Processing concepts; Short-Time Fourier Transform, Filter-Bank and LPC Methods.	**9**	**CO1 CO2**
2	Speech Analysis: Features, Feature Extraction and Pattern Comparison Techniques: Speech distortion measures – mathematical and perceptual – Log Spectral Distance, Cepstral Distances, Weighted Cepstral Distances and Filtering, Likelihood Distortions, Spectral Distortion using a Warped Frequency Scale, LPC, PLP and MFCC Coefficients, Time Alignment and Normalization – Dynamic Time Warping, Multiple Time – Alignment Paths.	**9**	**CO2 CO3**
3	Speech Modeling: Hidden Markov Models: Markov Processes, HMMs – Evaluation, Optimal State Sequence – Viterbi Search, Baum-Welch Parameter Re-estimation, Implementation issues.	**9**	**CO3**
4	Speech Recognition: Large Vocabulary Continuous Speech Recognition: Architecture of a large vocabulary continuous speech recognition system – acoustics and language models – ngrams, context dependent sub-word units; Applications and present status.	**9**	**CO3 CO4**
5	Speech Synthesis: Text-to-Speech Synthesis: Concatenative and waveform synthesis methods, subword units for TTS, intelligibility and naturalness – role of prosody, Applications and present status.	**9**	**CO4 CO5**

Text Books:

1. Lawrence Rabinerand Biing-Hwang Juang, "Fundamentals of Speech Recognition", Pearson Education, 2003.
2. Daniel Jurafsky and James H Martin, "Speech and Language Processing – An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Pearson Education.

Reference Books:

1. Steven W. Smith, "The Scientist and Engineer's Guide to Digital Signal Processing", California Technical Publishing
2 Thomas F Quatieri, "Discrete-Time Speech Signal Processing – Principles and Practice", Pearson Education.

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests (25 marks)	Assignment 1 (7.5 Marks)	Assignment 2 (7.5Marks)	Quiz1 (05Marks)	Quiz2 (05 Marks)
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	2.5	-	-	-	-
Evaluate	2.5	-	-	-	-
Create	-	-	-	-	-

SEE- Semester End Examination (50Marks)

Bloom's Category	Tests
Remember	10
Understand	20
Apply	20
Analyze	-
Evaluate	-
Create	-

EMBEDDED SYSTEMS

Course Code	**: 20AIM552A**	**Credits**	**: 3**
L: T: P: S:	**: 3: 0: 0: 0:**	**CIE Marks:**	**50**
Exam Hours:	**: 3**	**SEE Marks:**	**50**

Course Outcomes:	**At the end of the Course, the Student will be able to:**
CO#	**COURSE OUTCOME**
20AIM552A.1	Understand and apply the Fundamentals of embedded computer systems.
20AIM552A.2	Design and development of communication bus network
20AIM552A.3	Analyze how device driver routine works
20AIM552A.4	Design and develop modules using RTOS.
20AIM552A.5	Use modern tools with error free software to obtain target system

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM552A.1	3	-	-	-	-	-	-	-	-	-	-	3	3	2
20AIM552A.2	-	-	3	3	-	-	-	-	-	-	-	3	3	2
20AIM552A.3	-	3	-	-	-	-	-	-	-	-	-	3	3	2
20AIM552A.4	-	-	-	3	-	-	-	-	-	-	-	3	3	2
20AIM552A.5	-	-	-	-	3	-	-	-	-	-	-	3	3	2

Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)

Module No	Module Contents	Hours	COs
1	**Introduction to embedded systems:** Embedded systems, Processor embedded into a system, Embedded hardware units and device in a system, Embedded software in a system, Examples of embedded systems, Design process in embedded system, Formalization of system design, Design process and design examples, Classification of embedded systems, skills required for an embedded system designer.	**9**	**CO1 CO2**
2	**Devices and communication buses for devices network:** IO types and example, Serial communication devices, Parallel device ports, Sophisticated interfacing features in device ports, Wireless devices, Timer and counting devices, Watchdog timer, Real time clock, Networked embedded systems, Serial bus communication protocols, Parallel bus device protocols-parallel communication internet using ISA, PCI, PCI-X and advanced buses, Internet enabled systems network protocols, Wireless and mobile system protocols	**9**	**CO2 CO3**
3	**Device drivers and interrupts and service mechanism:** Programming-I/O busy-wait approach without interrupt service mechanism, ISR concept, Interrupt sources, Interrupt servicing (Handling) Mechanism, Multiple interrupts, Context and the periods for context switching, interrupt latency and deadline, Classification of processors interrupt service mechanism from Context-saving angle,	**9**	**CO2 CO3 CO4**

	Direct memory access, Device driver programming.		
4	**Real-time operating systems:** OS Services, Process management, Time functions, Event functions, Memory management, Device, file and IO subsystems management, Interrupt routines in RTOS environment and handling of interrupt source calls, Real-time operating systems, Basic design using an RTOS, RTOS task scheduling models, interrupt latency and response of the tasks as performance metrics, OS security issues Introduction to embedded software development process and tools, Host and target machines, Linking and location software.	**9**	**CO3 CO4**
5	Embedded Software Development Tools: Host and Target machines, Linker/Locators forEmbedded Software, Getting Embedded Software into the Target System; Debugging Techniques: Testing on Host Machine, Using Laboratory Tools, An Example System.	**9**	**CO3 CO5**

Text Books:

1. Raj Kamal, "Embedded Systems: Architecture, Programming, and Design" 2nd / 3rd edition , Tata McGraw hill-2013.
2. An Embedded Software Primer, David E. Simon, Pearson Education

Reference Books:

1. Marilyn Wolf, "Computer as Components, Principles of Embedded Computing System Design" 3rd edition, Elsevier-2014.

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests (25 marks)	Assignment 1 (7.5 Marks)	Assignment 2 (7.5Marks)	Quiz1 (05Marks)	Quiz2 (05 Marks)
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	5	-	-	-	-
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

SEE- Semester End Examination (50Marks)

Bloom's Category	Questions (50 marks)
Remember	10
Understand	10
Apply	20
Analyze	10
Evaluate	-
Create	-

SOFTWARE ENGINEERING

Course Code	**: 20AIM553A**	**Credits**	**: 3**
L: T: P: S:	**: 3: 0: 0: 0:**	**CIE Marks:**	**50**
Exam Hours:	**: 3**	**SEE Marks:**	**50**

Course Outcomes:	**At the end of the Course, the Student will be able to:**
CO#	**COURSE OUTCOME**
20AIM553A.1	Apply software engineering principles in real life projects
20AIM553A.2	Analyze for appropriate software development model in developing systems
20AIM553A.3	Develop software requirement sheet for a real life project, keeping in mind the properties of an SRS document
20AIM553A.4	Interpret mathematical models for calculating the size, cost and duration of real life projects
20AIM553A.5	Use latest tools in software engineering to test the developed system using different testing techniques

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM553A.1	3	-	-	-	-	-	-	-	-	-	-	3	3	3
20AIM553A.2	-	3	-	-	-	-	-	-	-	-	-	3	3	3
20AIM553A.3	-	-	3	-	-	-	-	-	-	-	-	3	3	3
20AIM553A.4	-	-	-	3	-	-	-	-	-	-	-	3	3	3
20AIM553A.5	-	-	-	-	3	-	-	-	-	-	-	3	3	3

Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)

Module No	Module Contents	Hour	COs
1	**Introduction:** The Software And Software Engineering Problem, Approach and Goals of Software Engineering. Software Processes and Models: Processes, Projects And Products, Component Software Processes, Characteristics Of A Software Process, Software Development Process, Project Management Process, Software Configuration Management Process. Models: Linear Sequential, Prototyping, Rad, Incremental, Spiral, Winwin Spiral, Concurrent Development Model	9	**CO1 CO2 CO3**
2	**Software requirement Analysis and Specification**: Software requirement, Feasibility study, need for SRS, characteristics and component of SRS specification languages, structured analysis, object oriented modeling, Requirement analysis, DFD, Structure of a requirement document, validation of SRS, requirement reviews, Cost estimation, uncertainties in cost estimation, building cost estimation. Size estimation:- COCOMO model.	9	**CO1 CO2**
3	Function Oriented design: Design principles, coupling, cohesion, design notation and specification, structured design technology, verification. Object Oriented Design : Overview of Object oriented design, UML diagram, Use CASE diagram, class diagram, interaction diagram (Sequence and collaboration diagram), Activity diagram Connected Cycles Network , Shuffle and Shuffle–Exchange Networks.	9	**CO2 CO3 CO4**

4	Software Testing techniques and strategies: Software testing objectives & principles, test case design, white box testing, black box testing.: A Strategic Approach to software testing, strategic issues, unit, integration testing, validation testing, system testing, object oriented program testing, debugging	**9**	**CO4 CO2**
5	**Software Re-engineering:** Software reengineering, software maintenance, a software reengineering process model, reverse engineering, restructuring code data restructuring, forward engineering, the Economics of reengineering .Computer Aided software Engineering: What is CASE, building blocks fo CASE, taxonomy of CASE tools, integrated CASE environment, the integration architecture, the case repository. Component Based Software Engineering: CBSE process, domain engineering,Component based development, economics of CBSE.	**9**	**CO4 CO5 CO1**

Text Books:

1. Pressman Roger, Software Engineering: A Practitioner's Approach TMH, Delhi.
2. JalotePankaj: An Integrated Approach to software Engineering, Narosa, Delhi.

Reference Books:

1. R.E. Fairly, Software Engineering Concepts, McGraw Hill, Inc 1985
2 Rajib Mall, "Fundamental of Software Engineering" , PHI.

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	**Tests (25 marks)**	**Assignment 1 (7.5 Marks)**	**Assignment 2 (7.5Marks)**	**Quiz1 (05Marks)**	**Quiz2 (05 Marks)**
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	2.5	-	-	-	-
Evaluate	2.5	-	-	-	-
Create	-	-	-	-	-

SEE- Semester End Examination (50Marks)

Bloom's Category	**Tests**
Remember	10
Understand	20
Apply	20
Analyze	-
Evaluate	-
Create	-

CRYPTOGRAPHY AND NETWORK SECURITY

Course Code	**: 20AIM554A**	**Credits:**	**3**
L: T: P: S:	**: 3: 0: 0: 0:**	**CIE Marks:**	**50**
Exam Hours:	**: 3**	**SEE Marks:**	**50**

Course Outcomes:	**At the end of the Course, the Student will be able to:**
CO#	**COURSE OUTCOME**
20AIM554A.1	Understand and apply the cryptography algorithms and its principles
20AIM554A.2	Analyze the standard algorithms used to provide confidentiality, integrity and Authenticity
20AIM554A.3	Illustrate Public and Private key cryptography
20AIM554A.4	Design and analyze the authentication and hashing techniques
20AIM554A.5	Develop strong password methods

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM554A.1	3	-	-	-	-	-	-	-	-	-	-	-	3	2
20AIM554A.2	-	3	-	-	-	-	-	-	-	-	-	-	3	2
20AIM554A.3	-	-	3	2	-	-	-	-	-	-	-	-	3	2
20AIM554A.4	-	-	-	3	-	-	-	-	-	-	-	-	3	2
20AIM554A.5	-	-	-	3	2	-	-	-	-	-	-	-	3	2

Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)

Module No.	**Module Contents**	**Hours**	**COs**
1	**Introduction to security attacks** Services and mechanism, classical encryption techniques- substitution ciphers and transposition ciphers, cryptanalysis, stream and block ciphers. Modern Block Ciphers: Block ciphers principals, Shannon's theory of confusion and diffusion, data encryption standard (DES), block cipher modes of operations, triple DES.	**9**	**CO1, CO2, CO3**
2	**Encryption Technique** AES, RC6, random number generation. S-box theory: Boolean Function, S-box design criteria, Bent functions, Propagation and nonlinearity, construction of balanced functions, S-box design.	**9**	**CO1, CO2, CO3**
3	**Public Key Cryptosystems** Principles of Public Key Cryptosystems, RSA Algorithm, security analysis of RSA Modular Arithmetic. Key Management in Public Key Cryptosystems: Distribution of Public Keys, Distribution of Secret keys using Public Key Cryptosystems, Diffie-Hellman Key Exchange	**9**	**CO1, CO2, CO3**

4	**Message Authentication and Hash Function** Authentication requirements, authentication functions, messag authentication code, hash functions, birthday attacks, security of has functions and MAC, MD5 message digest algorithm, Secure has algorithm(SHA). Digital Signatures: Digital Signatures, authenticatio protocols, digital signature standards (DSS), proof of digital signatur algorithm	**9**	**CO1, CO2, C04**
5	**Pretty Good Privacy** IP Security: Overview, IP Security Architecture, Authentication Header Encapsulation Security Payload in Transport and Tunnel mode with multiple security associations. Strong Password Protocols: Lamport's Hash, Encrypted Key Exchange.	**9**	**CO1, CO5,**

Text Books:

1. Stalling Williams: Cryptography and Network Security: Principles and Practices, 4th Edition, Pearson Education, 2006.

Reference Books:

1. Kaufman Charlie et.al; Network Security: Private Communication in a Public World, 2nd Ed., PHI/Pearson, 2002

2 Trappe & Washington, Introduction to Cryptography, 2nd Ed. Pearson, 2006

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests (25 marks)	Assignment 1 (7.5 Marks)	Assignment 2 (7.5Marks)	Quiz1 (05Marks)	Quiz2 (05 Marks)
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	2.5	-	-	-	-
Evaluate	2.5	-	-	-	-
Create	-	-	-	-	-

SEE- Semester End Examination (50Marks)

Bloom's Category	Tests
Remember	10
Understand	20
Apply	20
Analyze	-
Evaluate	-
Create	-

	VI SEMESTER											
S.No	Course Code	Course	BOS	Credit Distribution				Overall Credits	Contact Hours	Marks		
				L	T	P	S			CIE	SEE	Total
1	20AIM61A	Deep Learning Techniques	AIML	3	0	0	0	3	4	50	50	100
2	20AIM62A	Data Visualization	AIML	3	0	0	0	3	4	50	50	100
3	20AIM63A	Artificial Intelligence	AIML	3	0	0	0	3	4	50	50	100
4	21NHOPXX	Open Elective – I	AIML	2	0	1	0	3	4	50	50	100
5	20AIM64XA	Professional Elective – III	AIML	3	0	0	0	3	4	50	50	100
6	20AIM65XA	Professional Elective – IV	AIML	3	0	0	0	3	4	50	50	100
7	20AIL66A	Deep Learning Laboratory	AIML	0	0	2	0	2	4	25	25	50
8	20AIL67A	Data Visualization Laboratory	AIML	0	0	2	0	2	4	25	25	50
9	20AIM68A	Mini Project IV	AIML	0	0	2	0	2	2	25	25	50
Total								**24**	**34**	**375**	**375**	**750**

	Professional Elective - III	Open Elective - I	
Course Code	Course	Course Code	Course
20AIM641A	Biometrics	NHOP01	Big Data Analytics using HP Vertica-1
20AIM642A	Soft computing	NHOP02	VM Ware Virtualization Essentials-1
20AIM643A	Complier Design	NHOP04	Big Data Analytics using HP Vertica-2
20AIM644A	Computer Networks	NHOP05	VM Ware Virtualization Essentials-2

Professional Elective - IV		NHOP07	SAP
20AIM651A	Augmented & Virtual Reality	NHOP08	Schneider-Industrial Automation
20AIM652A	Pattern Recognition & Image Processing	NHOP09	Cisco-Routing and Switching-1
20AIM653A	Advanced Java	NHOP10	Data Analytics
20AIM654A	Block chain Technologies	NHOP11	Product Life Cycle Management
		NHOP12	CISCO-Routing and switching-2
		NHOP13	IIOT Embedded Systems
		NHOP14	Block chain

DEEP LEARNING TECHNIQUES

Course Code	**: 20AIM61A**	**Credits :**	**3**
L: T: P: S:	**: 3: 0: 0: 0:**	**CIE Marks:**	**50**
Exam Hours:	**: 3**	**SEE Marks:**	**50**

Course Outcomes:	**At the end of the Course, the Student will be able to:**
CO#	**COURSE OUTCOME**
20AIM61A.1	Understand the concepts of Neural networks, its main functions, operations and the execution pipeline
20AIM61A.2	Apply deep learning algorithms, neural networks and traverse the layers of data abstraction which will empower the student to understand data more precisely.
20AIM61A.3	Analyze deep learning models in Tensor Flow and interpret the results
20AIM61A.4	Design convolutional neural networks, training deep networks and high-level interfaces
20AIM61A.5	Use the language and fundamental concepts of artificial neural networks to solve real world problems.

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM61A.1	2	-	-	-	-	-	-	-	-	-	-	3	3	3
20AIM61A.2	3	-	-	-	-	2	-	-	-	-	-	-	3	-
20AIM61A.3	-	3	-	-	-	-	-	-	-	-	-	-	3	2
20AIM61A.4	-	-	3	-	-	-	-	-	-	-	-	-	3	3
20AIM61A.5	-	-	-		3	-	-	-	-	-	-	-	3	3
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)														

Module No	**Module Contents**	**Hours**	**COs**
1	BASICS OF NEURAL NETWORKS: Basic concept of Neurons – Perceptron Algorithm – Feed Forward and Back Propagation Networks.	**9**	**CO1**
2	INTRODUCTION TO DEEP LEARNING : Feed Forward Neural Networks , Gradient Descent, Back Propagation Algorithm: Vanishing Gradien problem – Mitigation – RelU Heuristics for Avoiding Bad Local Minima - Heuristics for Faster Training – Nestors Accelerated Gradient Descent – Regularization – Dropout.	**9**	**CO2**
3	CONVOLUTIONAL NEURAL NETWORKS : CNN Architectures – Convolution – Pooling Layers – Transfer Learning – Image Classification using Transfer Learning	**9**	**CO2, CO3**
4	MORE DEEP LEARNING ARCHITECTURES : LSTM, GRU, Encoder/Decoder Architectures – Autoencoders – Standard- Sparse – Denoising – Contractive- Variational Autoencoders – Adversarial Generative Networks – Autoencoder and DBM	**9**	**CO2, CO3, CO4**
5	APPLICATIONS OF DEEP LEARNING 9 Image Segmentation – Objec Detection – Automatic Image Captioning – Image generation with Generative Adversarial Networks – Video to Text with LSTM Models – Attention Models for Computer Vision.	**9**	**CO2, CO3, CO4 CO5**

Text Books:

1. Ian Good Fellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2017.
2. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.
3. Francois Chollet, "Deep Learning with Python", Manning Publications, 2018

Reference Books:

1. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009
2. Golub, G.,H., and Van Loan,C.,F., Matrix Computations, JHU Press,2013.

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests (25 marks)	Assignment 1 (7.5 Marks)	Assignment 2 (7.5Marks)	Quiz1 (05Marks)	Quiz2 (05 Marks)
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	2.5	-	-	-	-
Evaluate	2.5	-	-	-	-
Create	-	-	-	-	-

SEE- Semester End Examination (50Marks)

Bloom's Category	Tests
Remember	10
Understand	20
Apply	20
Analyze	-
Evaluate	-
Create	-

DATA VISUALIZATION

Course Code	**: 20AIM62A**	**Credits:**	**3**
L: T: P: S:	**: 3: 0: 0: 0:**	**CIE Marks:**	**50**
Exam Hours:	**: 3**	**SEE Marks:**	**50**

Course Outcomes:	**At the end of the Course, the Student will be able to:**
CO#	**COURSE OUTCOME**
20AIM62A.1	Understand the key techniques and theory behind data visualization
20AIM62A.2	Apply visualization techniques for various data analysis tasks.
20AIM62A.3	Analyze effectively the various visualization structures (like tables, spatial data, tree and network etc.)
20AIM62A.4	Design and build data visualization systems
20AIM62A.5	Evaluate information visualization systems and other forms of visual presentation for their effectiveness

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM62A.1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
20AIM62A.2	3	-	-	-	-	-	-	-	-	-	-	-	3	3
20AIM62A.3	-	3	-	-	3	-	-	-	-	-	-	-	3	2
20AIM62A.4	-	-	3	-	-	-	-	-	-	-	-	-	3	3
20AIM62A.5	-	-	-	3	3	-	-	-	-	-	-	-	3	3
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)														

Module No	**Module Contents**	**Hours**	**COs**
1	Value of Visualization – What is Visualization and Why do it: External representation – Interactivity – Difficulty in Validation. Data Abstraction: Dataset types – Attribute types – Semantics. Task Abstraction – Analyze, Produce, Search, Query. Four levels of validation – Validation approaches – Validation examples. Marks and Channels	**9**	**CO1**
2	Rules of thumb – Arrange tables: Categorical regions – Spatial axis orientation – Spatial layout density. Arrange spatial data: Geometry – Scalar fields – Vector fields – Tensor fields.	**9**	**CO1, CO2, CO3**
3	Arrange networks and trees: Connections, Matrix views – Containment. Map color: Color theory, Color maps and other channels.	**9**	**CO2, CO3**
4	Manipulate view: Change view over time – Select elements – Changing viewpoint – Reducing attributes.	**9**	**CO3, CO4**
5	Facet into multiple views: Juxtapose and Coordinate views – Partition into views – Static and Dynamic layers – Reduce items and attributes: Filter – Aggregate. Focus and context: Elide – Superimpose – Distort – Case studies.	**9**	**CO4, CO5**

Text Books:

1. Tamara Munzner, Visualization Analysis and Design, A K Peters Visualization Series, CRC Press, 2014.

Reference Books:

1. Scott Murray, Interactive Data Visualization for the Web, O'Reilly, 2013.
2. Nathan Yau, Visualize This: The FlowingData Guide to Design, Visualization and Statistics, John Wiley & Sons, 2011.

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests (25 marks)	Assignment 1 (7.5 Marks)	Assignment 2 (7.5Marks)	Quiz1 (05Marks)	Quiz2 (05 Marks)
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	2.5	-	-	-	-
Evaluate	2.5	-	-	-	-
Create	-	-	-	-	-

SEE- Semester End Examination (50Marks)

Bloom's Category	Tests
Remember	10
Understand	20
Apply	20
Analyze	-
Evaluate	-
Create	-

ARTIFICIAL INTELLIGENCE

Course Code	**: 20AIM63A**	**Credits :**	**3**
L: T: P: S:	**: 3: 0: 0: 0:**	**CIE Marks:**	**50**
Exam Hours:	**: 3**	**SEE Marks:**	**50**

Course Outcomes:	**At the end of the Course, the Student will be able to:**
CO#	**COURSE OUTCOME**
20AIM63A.1	Apply the basic knowledge representation, problem solving, and learning methods of artificial intelligence.
20AIM63A.2	Analyze various search techniques used to solve AI problems.
20AIM63A.3	Design the machine learning, fuzzy logic, genetic algorithms to solve problems.
20AIM63A.4	Evaluate the various statistical reasoning techniques to solve AI problems.
20AIM63A.5	Use analytical concepts for solving logical problems using heuristics approaches.

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM63A.1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
20AIM63A.2	-	3	-	-	3	-	-	-	-	-	-	-	3	2
20AIM63A.3	-	-	3	-	-	-	-	-	-	-	-	-	3	3
20AIM63A.4	-	-	-	3	3	-	-	-	-	-	-	-	3	3
20AIM63A.5	-	-	-	-	3	-	-	-	-	-	-	-	3	3
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)														

Module No	Module Contents	Hours	COs
1	Basics of AI, Artificial Intelligence Problems, Artificial Intelligence Techniques, applications of AI Problem Spaces and Search : Defining the problem as a state space search, Production systems, Production system characteristics, Problem characteristics	9	**CO1**
2	Informed Search Strategies : Heuristic functions, Generate and Test, Hill Climbing, Simulated Annealing, Best first search, A* algorithm, Constraint satisfaction	9	**CO2**
3	Knowledge Representation : Representations & mappings, Approaches in knowledge representation, Issues in knowledge representation, Propositional logic, Predicate logic, Procedural versus declarative knowledge	9	**CO3**
4	Statistical reasoning : Probability & Bayes' theorem, Bayesian networks, Certainty factors & rule-based systems Weak slot and filler structures : Semantic nets, Frames Strong slot and filler structures : Conceptual dependency	9	**CO4**
5	AI Programming language: Introduction to PROLOG and LISP, Programming techniques, Syntax and Numeric Functions; predicates and conditionals, List manipulation , redundancy and termination, Iteration and Recursion	9	**CO5, CO6**

Text Books:

1. Artificial Intelligence by Rich, Knight, McGraw Hill Education

Reference Books:

1. Artificial Intelligence By Kevin Knight, Elaine Rich, B. Shivashankar Nair, Tata Mcgraw Hill, India
2. Artificial Intelligence And Intelligent System BY N. P. Padhy, Oxford University Press

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests (25 marks)	Assignment 1 (7.5 Marks)	Assignment 2 (7.5Marks)	Quiz1 (05Marks)	Quiz2 (05 Marks)
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	2.5	-	-	-	-
Evaluate	2.5	-	-	-	-
Create	-	-	-	-	-

SEE- Semester End Examination (50Marks)

Bloom's Category	Questions (50 marks)
Remember	10
Understand	10
Apply	20
Analyze	5
Evaluate	5
Create	-

DEEP LEARNING LABORATORY

Course Code	**: 20AIL66A**	**Credits**	**: 2**
L: T: P: S:	**: 0: 0: 2: 0:**	**CIE Marks:**	**25**
Exam Hours:	**: 3**	**SEE Marks:**	**25**

Course Outcomes:	**At the end of the Course, the Student will be able to:**
CO#	**COURSE OUTCOME**
20AIM66A.1	Apply the various deep learning algorithms in Python.
20AIM66A.2	Analyze and improve deep learning models
20AIM66A.3	Build deep learning models in TensorFlow and interpret the results
20AIM66A.4	Evaluate different deep learning frameworks like Keras, Tensor flow, PyTorch, Caffe etc.

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM66A.1	3	-	-	-	-	-	-	-	-	-	-	3	3	3
20AIM66A.2	-	3	-	-	3	-	-	-	-	-	-	3	3	2
20AIM66A.3	-	-	-	-	3	-	-	-	-	-	-	3	3	3
20AIM66A.4	-	-	-	3	3	-	-	-	-	-	-	3	3	3
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)														

Ex. No	Experiments	Hours	COs
1.	Basic image processing operations : Histogram equalization, thresholding, edge detection, data augmentation, morphological operations	**4**	**CO1 CO2 CO3 CO4**
2.	Implement SVM/Softmax classifier for CIFAR-10 dataset: (i) using KNN, (ii) using 3 layer neural network	**4**	**CO1 CO2 CO3 CO4**
3.	Study the effect of batch normalization and dropout in neural network classifier	**4**	**CO1 CO2 CO3 CO4**
4.	Familiarization of image labelling tools for object detection, segmentation	**4**	**CO1 CO2 CO3 CO4**
5.	Image segmentation using Mask RCNN, UNet, SegNet	**4**	**CO1 CO2 CO3 CO4**
6.	Object detection with single-stage and two-stage detectors (Yolo, SSD, FRCNN, etc.)	**4**	**CO1 CO2 CO3 CO4**
7.	Image Captioning with Vanilla RNNs	**4**	**CO1 CO2 CO3 CO4**
8.	Image Captioning with LSTMs	**4**	**CO1 CO2 CO3**

			CO4
9.	Network Visualization: Saliency maps, Class Visualization	**4**	**CO1 CO2 CO3 CO4**
10.	Generative Adversarial Networks	**4**	**CO1 CO2 CO3 CO4**
11.	Chatbot using bi-directional LSTMs	**4**	**CO1 CO2 CO3 CO4**
12.	Familiarization of cloud based computing like Google colab	**4**	**CO1 CO2 CO3 CO4**

Text Books:

1. Goodfellow, I., Bengio,Y., and Courville, A., Deep Learning, MIT Press, 2016.
2. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.

Reference Books:

1. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009
2. Golub, G.,H., and Van Loan,C.,F., Matrix Computations, JHU Press,2013.

CIE- Continuous Internal Evaluation (25 Marks)

Bloom's Category	Review (25marks)
Remember	-
Understand	-
Apply	10
Analyze	10
Evaluate	5
Create	-

SEE- Semester End Examination (25Marks)

Bloom's Category	Review (25marks)
Remember	-
Understand	-
Apply	10
Analyze	10
Evaluate	5
Create	-

DATA VISUALIZATION LABORATORY

Course Code	**: 20AIL67A**	**Credits :**	**2**
L: T: P: S:	**: 0: 0: 2: 0:**	**CIE Marks:**	**25**
Exam Hours:	**: 3**	**SEE Marks:**	**25**

Course Outcomes:	**At the end of the Course, the Student will be able to:**
CO#	**COURSE OUTCOME**
20AIM67A.1	Apply visualization on Trends and uncertainty
20AIM67A.2	Demonstrate basics of Data Visualization
20AIM67A.3	Implement visualization of distributions
20AIM67A.4	Design and develop visualization of time series, proportions & associations

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM67A.1	3	-	-	-	3	-	-	-	-	-	-	3	3	3
20AIM67A.2	3	-	-	-	-	-	-	-	-	-	-	3	3	3
20AIM67A.3	3	-	-	-	-	-	-	-	-	-	-	3	3	3
20AIM67A.4	-	-	3	-	-	-	-	-	-	-	-	3	3	3
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)														

Exp. No	**Experiment**	**Hours**	**COs**
1	Download the House Pricing dataset from Kaggle and map the values to Aesthetics	**4**	**CO1**
2	Use different Color scales on the Rainfall Prediction dataset	**4**	**CO1**
3	Create different Bar plots for variables in any dataset	**4**	**CO2, CO3**
4	Show an example of Skewed data and removal of skewedness	**4**	**CO2, CO3**
5	For a sales dataset do a Time Series visualization	**4**	**CO2, CO3**
6	Build a Scatterplot and suggest dimension reduction	**4**	**CO2, CO3**
7	Use Geospatial Data-Projections on datasets in http://www.gisinindia.com/directory/gis-data-for-india	**4**	**CO2, CO3**
8	Create the a trend line with a confidence band in any suitable dataset	**4**	**CO2, CO3**
9	Illustrate Partial Transparency and Jittering	**4**	**CO2, CO3**
10	Illustrate usage of different color codes	**4**	**CO2, CO3**

Text Books:

1. Tamara Munzner, Visualization Analysis and Design, A K Peters Visualization Series, CRC Press, 2014.

Reference Books:

1. Scott Murray, Interactive Data Visualization for the Web, O'Reilly, 2013.
2. Nathan Yau, Visualize This: The FlowingData Guide to Design, Visualization and Statistics, John Wiley & Sons, 2011.

CIE- Continuous Internal Evaluation (25 Marks)

Bloom's Category	Review (25marks)
Remember	-
Understand	-
Apply	10
Analyze	10
Evaluate	5
Create	-

SEE- Semester End Examination (25Marks)

Bloom's Category	Review (25marks)
Remember	-
Understand	-
Apply	10
Analyze	10
Evaluate	5
Create	-

MINI PROJECT - IV

Course Code	**: 20AIM68A**	**Credits :**	**2**
L: T: P: S:	**: 0: 0: 2: 0:**	**CIE Marks:**	**25**
Exam Hours:	**: 3**	**SEE Marks:**	**25**

Course Outcomes:	**At the end of the Course, the Student will be able to**
CO#	COURSE OUTCOME
20AIM39.1	Understand the technological needs and/ or societal needs and sustainability of the environment
20AIM39.2	Analyze and evaluate the outcome of the project
20AIM39.3	Design application using Deep learning techniques
20AIM39.4	Evaluate, validate and communicate the identified solutions in a structured way.

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM39.1	3	-	-	-	-	3	2	3	-	-	-	3	3	2
20AIM39.2	-	3	-	-	-	-	-	-	-	-	-	3	3	2
20AIM39.3	-	-	3	-	3	-	-	-	-	-	-	3	3	2
20AIM39.4	-	-	-	3	-	-	-	-	3	3	3	3	3	2
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)														

Each team capable of identifying a problem and carry out a mini project on the problem defined. A panel of experts will review the code developed towards the project during the course of the semester. Plagiarized projects will automatically get an **"F" GRADE** and the student will be liable for further disciplinary action. At the completion of a project, the team will submit a project report, which will be evaluated by duly appointed examiner(s).

CIE- Continuous Internal Evaluation (25 Marks)

Bloom's Category	**Review (25marks)**
Remember	-
Understand	-
Apply	10
Analyze	10
Evaluate	5
Create	-

SEE- Semester End Examination (25Marks)

Bloom's Category	**Review (25marks)**
Remember	-
Understand	-
Apply	10
Analyze	10
Evaluate	5
Create	-

BIOMETRICS

Course Code	**: 20AIM641A**	**Credits :**	**3**
L: T: P: S:	**: 3: 0: 0: 0:**	**CIE Marks:**	**50**
Exam Hours:	**: 3**	**SEE Marks:**	**50**

Course Outcomes:	**At the end of the Course, the Student will be able to:**
CO#	**COURSE OUTCOME**
20AIM641A.1	Be able to draw a system-level diagram for any biometric system and discuss its components
20AIM641A.2	Be able to solve verification, identification, and synthesis problems for a variety of biometrics such as fingerprint, face, iris, hand gestures and cryptography.
20AIM641A.3	Be able to use the biometrics ingredients of existing system to obtain a given security goal.
20AIM641A.4	Be able to design a biometric solution for a given application
20AIM641A.5	Apply security features in block chain technologies

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM641A.1	3	-	-	-	-	-	-	-	-	-	-	3	3	3
20AIM641A.2	-	3	-	-	-	-	-	-	-	-	-	3	3	3
20AIM641A.3	-	-	3	-	-	-	-	-	-	-	-	3	3	3
20AIM641A.4	-	-	-	3	-	-	-	-	-	-	-	3	3	3
20AIM641A.5	-	-	-	3	3	-	-	-	-	-	-	3	3	3
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)														

Module No	**Module Contents**	**Hours**	**COs**
1	Biometrics: definition, history, basic working architecture, types; Performance measures of biometrics; applications and benefits of biometrics;design of biometrics; biometric identification versus verification.	**9**	**CO1**
2	Background of face and iris recognition; Face recognition methods: Eigen face methods, contractive transformation method; Challenges of face biometrics; Design of iris biometrics: image segmentation, image preprocessing, determination of iris region; Advantages and disadvantages of face and iris biometrics.	**9**	**CO2 CO3**
3	Fingerprint matching: image acquisition, image enhancement and segmentation, image binarization, minutiae extraction and matching; Sign language biometrics: Indian sign language (ISL) biometrics, SIFT algorithm, advantages and disadvantages of ISL and fingerprint biometrics.	**9**	**CO3**
4	Introduction to biometric cryptography; general purpose cryptosystems; Cryptographic algorithms: DES and RSA; Privacy concerns and issues related to biometrics; biometrics with privacy enhancement; soft biometrics; comparison of various biometrics; Identity and privacy Multimodal biometrics: basic architecture and	**9**	**CO4 CO2 CO3**
5	fusion scheme, application, example of AADHAAR; scope and future market of biometrics; role of biometrics in enterprise and border security; DNA biometrics; biometric standards; biometric APIs.	**9**	**CO5**

Text Books:

1. Introduction to biometrics by Anil K Jain, Arun Ross and Karthik Nandakumar, Springer, 2011.
2. Biometrics Identity verification in a networked world by Samir nanawati, Michael Thieme and Raj Nanawati, US editionof WileyIndia,2012.

Reference Books:

1. Privacy Enhancing Biometric, Chuck Wilson, Vein pattern recognition, CRC press 2010
2. Biometrics: Identity Verification in a Network, 1stEdition, Samir Nanavathi, Michel Thieme, and Raj Nanavathi, Wiley Eastern, 2002

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests (25 marks)	Assignment 1 (7.5 Marks)	Assignment 2 (7.5Marks)	Quiz1 (05Marks)	Quiz2 (05 Marks)
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	5	-	-	-	-
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

SEE- Semester End Examination (50Marks)

Bloom's Category	Questions (50 marks)
Remember	10
Understand	10
Apply	20
Analyze	10
Evaluate	-
Create	-

Soft Computing

Course Code	**: 20AIM642A**	**Credits**	**: 3**
L: T: P: S	**: 3: 0: 0: 0**	**CIE Marks**	**: 50**
Exam Hours	**: 3**	**SEE Marks**	**: 50**

Course Outcomes:	At the end of the course, students should be able to
CO#	Course Outcomes
20AIM642A.1	Recognize and apply soft computing theories in the creation of intelligent machines.
20AIM642A.2	Identify and determine the feasibility of applying neural networks to a particular problem.
20AIM642A.3	Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.
20AIM642A.4	Apply genetic algorithms to optimization problems
20AIM642A.5	Design neural networks for pattern classification and regression problems
20AIM642A.6	Compare different neural network approaches.

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM642A.1	3	3	3	-	-	-	-	-	-	-	-	-	3	2
20AIM642A.2	3	3	3	-	2	-	-	-	-	-	-	-	3	2
20AIM642A.3	3	3	-	-	-	-	-	-	-	-	-	-	3	3
20AIM642A.4	3	2	3	3	-	-	-	-	-	-	-	-	3	3
20AIM642A.5	3	3	3	2	-	-	-	-	-	-	-	-	3	3
20AIM642A.6	3	2	2	-	-	-	-	-	-	-	-	-	3	2

Module No.	Module Contents	Hours	COs
1	**INTRODUCTION TO SOFT COMPUTING** Introduction-Artificial Intelligence-Artificial Neural Networks-Fuzzy Systems-Genetic Algorithm and Evolutionary of Neural Networks-Classification of ANNs-McCulloch and Pitts Neuron Model-Learning Rules: Hebbian and Delta- Perceptron Network-Adaline Network-Madaline Network.	9	CO1, CO2
2	**ARTIFICIAL NEURAL NETWORKS** Back propagation Neural Networks - Kohonen Neural Network -Learning Vector Quantization -Hamming Neural Network - Hopfield Neural Network- Bi-directional, Associative Memory -Adaptive Resonance Theory Neural Networks.	9	CO1, CO2
3	**FUZZY SYSTEMS** Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets - Classical Relations and Fuzzy Relations -Membership Functions -Defuzzification - Fuzzy Arithmetic and Fuzzy Measures - Fuzzy Rule Base and Approximate Reasoning - Introduction to Fuzzy Decision Making.	9	CO3

4	**GENETIC ALGORITHMS** Basic Concepts – Working Principle – Procedures of GA – Flow Chart of GA – Genetic Representation: (Encoding) Initialization and Selection – Genetic Operators: Mutation, Generational Cycle – Applications..	9	CO4
5	**Hybrid Soft Computing Techniques:** Neuro-Fuzzy Hybrid Systems-Adaptive Neuro-Fuzzy Inference System(ANFIS)-Genetic Neuro-Hybrid Systems-Genetic Fuzzy Hybrid and Fuzzy Genetic Hybrid Systems- Simplified Fuzzy ARTMAP- Applications	9	CO5, CO6

Text Books:

1. S.N. Sivanandam, S.N. Deepa, "Principles of Soft Computing", Third Edition, Wiley-India, 2008
2. S. Rajasekaran, G.A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications", Prentice Hall of India, 2010.

Reference Books :

1. Siman Haykin, "Neural Networks", Prentice Hall of India, 1999.
2. Timothy Ross, "Fuzzy Logic with Engineering Applications", Wiley Publications, 2016.
3. David E. Goldberg, "Genetic Algorithms in Search, Optimization and Machine Learning", Pearson Education, 2008.

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests (25 marks)	Assignment 1 (7.5 Marks)	Assignment 2 (7.5Marks)	Quiz1 (05Marks)	Quiz2 (05 Marks)
Remember	5	2.5	2.5	2.5	2.5
Understand	5	2.5	2.5	2.5	2.5
Apply	10	2.5	2.5	-	-
Analyze	2.5	-	-	-	-
Evaluate	2.5	-	-	-	-
Create	-	-	-	-	-

SEE- Semester End Examination (50Marks)

Bloom's Category	Questions (50 marks)
Remember	10
Understand	10
Apply	20
Analyze	5
Evaluate	5
Create	-

COMPILER DESIGN

Course Code	**: 20AIM643A**	**Credits :**	**3**
L: T: P: S:	**: 3: 0: 0: 0:**	**CIE Marks:**	**50**
Exam Hours:	**: 3**	**SEE Marks:**	**50**

Course Outcomes:	**At the end of the Course, the Student will be able to:**
CO#	**COURSE OUTCOME**
20AIM643A.1	Apply the concepts of different Parsing techniques and implement the knowledge to Yacc tool.
20AIM643A.2	Analyse the concepts of Compilers and roles of the lexical analyzer.
20AIM643A.3	Implement the principles of scoping, parameter passing and runtime memory management.
20AIM643A.4	Develop syntax directed translation schemes.
20AIM643A.5	Use the new code optimization techniques to improve the performance of a program in terms of speed & space and develop algorithms to generate code for a target machine.

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM643.1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
20AIM643.2	-	3	-	-	3	-	-	-	-	-	-	-	3	2
20AIM643.3	-	3	-	-	3	-	-	-	-	-	-	-	3	3
20AIM643.4	3	-	-	-	-	-	-	-	-	-	-	-	3	3
20AIM643.5	-	-	-	3	3	-	-	-	-	-	-	-	3	3
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)														

Module No	**Module Contents**	**Hours**	**COs**
1	Introduction : Introduction to Compiler, single and multi-pass compilers, Translators, Phases of Compilers, Compiler writing tools, Finite Automata and Lexical Analyzer: Role of Lexical Analyzer, Specification of tokens, Recognition of tokens, Regular expression, Finite automata, from regular expression to finite automata, transition diagrams, Implementation of lexical analyzer with LEX.	**9**	**CO1, CO2**
2	Syntax Analysis and Parsing Techniques : Context free grammars, Bottom-up parsing and top down parsing, Top down Parsing : elimination of left recursion, recursive descent parsing, Predicative Parsing, Bottom Up Parsing : Operator precedence parsing, LR parsers, Construction of SLR, Canonical LR and LALR parsing tables, Construction of SLR parse tables for Ambiguous grammar, parser generator- YACC, error recovery in top down and bottom up parsing	**9**	**CO1, CO2**
3	Syntax Directed Translation & Intermediate Code Generation : Synthesized and inherited attributes, Construction of syntax trees, bottom up and top down evaluation of attributes, S- attributed and Lattributed definitions ,Postfix notation; Three address codes, quadruples, triples and indirect triples, Translation of assignment statements, control flow, Boolean expression and Procedure Calls.	**9**	**CO3, CO4**
4	Run-time Environment: Storage organization, activation trees, activation records, allocation strategies, Parameter passing symbol table, dynamic storage allocation.	**9**	**CO3, CO4**
5	Code Optimization and Code Generation : Basic blocks and flow graphs, Optimization of basic blocks, Loop optimization, Global data	**9**	**CO3, CO5**

	flow analysis, Loop invariant computations. Issue in the design of Code generator, register allocation, the target machine, and simple Code generator.		

Text Books:

1. Compilers Principles, Techniques and Tools, Alfred V. Aho, Ravi Sethi and Ullman J.D., 2nd edition , Addison Wesley.
2. Principle of Compiler Design, Alfred V. Aho and J.D. Ullman, Narosa Publication

Reference Books:

1. Compiler Design in C, A.C. Holub, PHI.
2. Compiler Design, O.G. Kakde, 4th edition, Laxmi Publication.
3. Compiler construction (Theory and Practice), A. Barret William and R.M., Bates, Galgotia Publication

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests (25 marks)	Assignment 1 (7.5 Marks)	Assignment 2 (7.5Marks)	Quiz1 (05Marks)	Quiz2 (05 Marks)
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	2.5	-	-	-	-
Evaluate	2.5	-	-	-	-
Create	-	-	-	-	-

SEE- Semester End Examination (50Marks)

Bloom's Category	Questions (50 marks)
Remember	10
Understand	10
Apply	20
Analyze	5
Evaluate	5
Create	-

COMPUTER NETWORK

Course Code	**: 20AIM644A**	**Credits :**	**3**
L: T: P: S:	**: 3: 0: 0: 0:**	**CIE Marks:**	**50**
Exam Hours:	**: 3**	**SEE Marks:**	**50**

Course Outcomes:	**At the end of the Course, the Student will be able to:**
CO#	**COURSE OUTCOME**
20AIM644A.1	Understand the basic structure of an abstract layered Network protocol model for any Networking environment
20AIM644A.2	Identify and apply basic theorems and formulae for the information-theoretic basis of communication and the performance of TCP/IP network protocols.
20AIM644A.3	Analyze necessary tools to support a career in Computer Networking at advanced professional level.
20AIM644A.4	Evaluate different protocols, software, and network architectures, their topologies, protocols in any networking application domains.
20AIM644A.5	Use security measures in real world scenario

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM644.1	3	-	-	-	-	-	-	-	-	-	-	3	3	3
20AIM644.2	3	3	-	-	-	-	-	-	-	-	-	3	3	3
20AIM644.3	-	3	-	-	-	-	-	-	-	-	-	3	3	2
20AIM644.4	-	-	-	3	3	-	-	-	-	-	-	3	3	3
20AIM644.5	-	-	-	3	3	-	-	-	-	-	-	3	3	3

Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)

Module No	Module Contents	Hours	COs
1	Introduction: OSI, TCP/IP and other networks models, Network Topologies WAN, LAN, MAN. Transmission media copper, twisted pair wireless, switching and Multiplexing and De-multiplexing, Networking Devices.	**9**	**CO1, CO2**
2	Data link layer: Framing, Error detection and correction, Flow Control. Multiple Access Protocols – Data Link Layer Addressing, ARP, RARP, DHCP, Ethernet standards. Media Access Control Protocols. MAC addresses. Wireless LANS. High Level Data Link Control, Asynchronous Transfer Mode.	**9**	**CO1, CO2**
3	Network Layer: Internet Protocol (IP), IPv4 and IPv6, Sub-netting and Super-netting, ICMP, Unicast Routing Protocols: Link State Routing, Distance Vector Routing, Hierarchical Routing, RIP, OSPF, BGP Multicast Routing, Multicast Routing Protocols: DVMRP, MOSPF, CBT, PIM, MBONE, Mobile IP, IPsec.	**9**	**CO3**
4	Transport Layer: Transport Layer Services Connectionless Protocols: UDP, UDP segment, Reliable Data Transfer. Connection-Oriented Protocols: TCP Segment Structure, RTT estimation, Flow Control, Connection Management, Congestion Control, Integrated and Differentiated Services: Intserv – Diffserv.	**9**	**CO2, CO3, CO4**
5	Application Layer: Principles of Network Applications, The Web and HTTP, FTP, Electronic Mail, SMTP, Mail Message Formats and MIME, DNS, Socket Programming with TCP and UDP.	**9**	**CO2, CO3, CO5**

	Multimedia Networking: Internet Telephony, RTP, RTCP, RTSP. Network Security: Principles of Cryptography, Firewalls, Attacks and Countermeasures.		

Text Books:

1. Data Communications and Networking – Behrouz A. Forouzan.Third Edition TMH
2. Computer Networks — Andrew S Tanenbaum, 4th Edition. Pearson Education/PHI

Reference Books:

1. James F. Kurose and Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", Pearson Education, Third edition, 2006
2. An Engineering Approach to Computer Networks-S.Keshav, 2nd Edition, Pearson Education

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests (25 marks)	Assignment 1 (7.5 Marks)	Assignment 2 (7.5Marks)	Quiz1 (05Marks)	Quiz2 (05 Marks)
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	2.5	-	-	-	-
Evaluate	2.5	-	-	-	-
Create	-	-	-	-	-

SEE- Semester End Examination (50Marks)

Bloom's Category	Questions (50 marks)
Remember	10
Understand	10
Apply	20
Analyze	5
Evaluate	5
Create	-

AUGMENTED AND VIRTUAL REALITY

Course Code	**: 20AIM651A**	**Credits:**	**3**
L: T: P: S:	**: 3: 0: 0: 0:**	**CIE Marks:**	**50**
Exam Hours:	**: 3**	**SEE Marks:**	**50**

Course Outcomes:	**At the end of the Course, the Student will be able to:**
CO#	**COURSE OUTCOME**
20AIM651.1	Understand the importance of Augmented reality
20AIM651.2	Apply the computer vision for Augmented reality and its applications
20AIM651.3	Implement the basic concepts of Virtual Reality
20AIM651.4	Analyze the importance of Tracking system.
20AIM651.5	Use the concepts of Computer Graphics and allied concepts for design of Virtual Reality

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM651.1	3	-	-	-	-	-	-	-	-	-	-	-	3	3
20AIM651.2	3	-	-	-	-	-	-	-	-	-	-	-	3	3
20AIM651.3	3	3	-	-	-	-	-	-	-	-	-	-	3	3
20AIM651.4	-	3	-	-	3	-	-	-	-	-	-	-	3	2
20AIM651.5	-	-	-	3	3	-	-	-	-	-	-	-	3	3

Module No	**Module Contents**	**Hours**	**COs**
1	Introduction to Augmented Reality: What Is Augmented Reality - Defining augmented reality, history of augmented reality, Examples, Displays-Multimodal Displays, Visual Perception, Requirements and Characteristics, Spatial Display Model	**9**	**CO1**
2	Tracking: Tracking, Calibration, and Registration, Characteristics of Tracking Technology, Stationary Tracking Systems, Mobile Sensors, Optical Tracking, Sensor Fusion	**9**	**CO1, CO2, CO4**
3	Computer Vision for Augmented Reality-Marker Tracking, Multiple-Camera Infrared Tracking, Natural Feature Tracking by Detection, Incremental Tracking, Simultaneous Localization and Mapping, Outdoor Tracking Calibration and Registration-Camera Calibration, Display Calibration, Registration	**9**	**CO1, CO4**
4	Introduction to Virtual Reality: Fundamental Concept and Components of Virtual Reality. Primary Features and Present Development on Virtual Reality. Multiple Models of Input and Output Interface in Virtual Reality: Input - Tracker, Sensor, Digital Glove, Movement Capture, Video-based Input, 3D Menus & 3DScanner etc. Output -- Visual /Auditory / Haptic Devices	**9**	**CO3, CO4, CO5**
5	Visual Computation in Virtual Reality: Fundamentals of Computer Graphics. Software and Hardware Technology on Stereoscopic Display. Advanced Techniques in CG: Management of Large Scale Environments & Real Time Rendering. Interactive Techniques in Virtual Reality: Body Track, Hand Gesture, 3D Manus, Object Grasp Development Tools and Frameworks in Virtual Reality: Frameworks of Software Development Tools in VR.X3D Standard; Vega, MultiGen, Virtools etc.	**9**	**CO3, CO5**

Text Books:

1. Augmented Reality: Principles and Practice by Dieter SCHMALSTIEG,Tobias HOLLERER
2. Virtual Reality Technology Burdea, G. C. P. Coffet Wiley-IEEE Press 2nd Edition 2003/2006

Reference Books:

1. Augmented Reality: Principles & Practice by Schmalstieg / Hollerer, Pearson Education India; First edition (12 October 2016),ISBN-10: 9332578494
2. Developing Virtual Reality Applications, Foundations of Effective Design Alan Craig William Sherman Jeffrey Will Morgan Kaufmann 2009

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests (25 marks)	Assignment 1 (7.5 Marks)	Assignment 2 (7.5Marks)	Quiz1 (05Marks)	Quiz2 (05 Marks)
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	2.5	-	-	-	-
Evaluate	2.5	-	-	-	-
Create	-	-	-	-	-

SEE- Semester End Examination (50Marks)

Bloom's Category	Questions (50 marks)
Remember	10
Understand	10
Apply	20
Analyze	5
Evaluate	5
Create	-

PATTERN RECOGNITION AND IMAGE PROCESSING

Course Code	**: 20AIM652A**	**Credits**	**: 3**
L: T: P: S:	**: 3: 0: 0: 0:**	**CIE Marks:**	**50**
Exam Hours:	**: 3**	**SEE Marks:**	**50**

Course Outcomes:	**At the end of the Course, the Student will be able to:**
CO#	**COURSE OUTCOME**
20AIM625A.1	Understand the basics of Image formation and transformation using sampling and quantization
20AIM625A.2	Apply compression and coding techniques used for image data
20AIM625A.3	Analyze different types Segmentation Techniques.
20AIM625A.4	Evaluate the trade-offs, and appropriateness of the different feature types and classification techniques such as Bayesian, maximum-likelihood, etc
20AIM625A.5	Investigate the nature and inherent difficulties of the pattern recognition problems

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM625A.1	3	-	-	-	-	-	-	-	-	-	-	3	3	3
20AIM625A.2	3	-	-	-	-	-	-	-	-	-	-	3	3	3
20AIM625A.3	-	3	-	-	3	-	-	-	-	-	-	3	3	2
20AIM625A.4	3	-	-	3	3	-	-	-	-	-	-	3	3	3
20AIM625A.5	-	-	3	3	-	-	-	-	2	2	-	3	3	3
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)														

Module No	**Module Contents**	**Hours**	**COs**
1	**Introduction to Image Processing:** Image formation, image geometry perspective and other transformation, stereo imaging elements of visual perception. Digital Image-sampling and quantization serial & parallel Image processing.	**9**	**CO1**
2	**Image Restoration:** Image Restoration-Constrained and unconstrained restoration Wiener filter , motion blur remover, geometric and radiometric correction Image data compression-Huffman and other codes transform compression, predictive compression two tone Image compression, block coding, run length coding, and contour coding.	**9**	**CO1, CO2**
3	**Segmentation Techniques:** Segmentation Techniques-thresh holding approaches, region growing, relaxation, line and edge detection approaches, edge linking, supervised and unsupervised classification techniques, remotely sensed image analysis and applications, Shape Analysis – Gestalt principles, shape number, moment Fourier and other shape descriptors, Skelton detection, Hough trans-form, topological and texture analysis, shape matching.	**9**	**CO3, CO4**
4	**Pattern Recognition:** Basics of pattern recognition, Design principles of pattern recognition system, Learning and adaptation, Pattern recognition approaches, Mathematical foundations – Linear algebra, Probability Theory, Expectation, mean and covariance, Normal distribution, multivariate normal densities, Chi squared test.	**9**	**CO4, CO5**
5	**Statistical Patten Recognition:** Bayesian Decision Theory, Classifiers, Normal density and discriminant functions, Parameter estimation	**9**	**CO5**

	methods: Maximum-Likelihood estimation, Bayesian Parameter estimation, Dimension reduction methods – Principal Component Analysis (PCA), Fisher Linear discriminant analysis, Expectation-maximization (EM), Hidden Markov Models (HMM),Gaussian mixture models.		

Text Books:

1. Digital Image Processing – Ganzalez and Wood, Addison Wesley, 1993.
2. Fundamental of Image Processing – Anil K.Jain, Prentice Hall of India.
3. Pattern Classification – R.O. Duda, P.E. Hart and D.G. Stork, Second Edition John Wiley, 2006

Reference Books:

1. Digital Picture Processing – Rosenfeld and Kak, vol.I & vol.II, Academic,1982
2. An Introduction to Digital Image Processing – Wayne Niblack, Prentice Hall, 1986
3. Pattern Recognition and Machine Learning – C. M. Bishop, Springer, 2009.
4. Pattern Recognition – S. Theodoridis and K. Koutroumbas, 4th Edition, Academic Press,2009

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests (25 marks)	Assignment 1 (7.5 Marks)	Assignment 2 (7.5Marks)	Quiz1 (05Marks)	Quiz2 (05 Marks)
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	5	-	-	-	-
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

SEE- Semester End Examination (50Marks)

Bloom's Category	Questions (50 marks)
Remember	10
Understand	10
Apply	20
Analyze	10
Evaluate	-
Create	-

ADVANCED JAVA

Course Code	**: 20AIM653A**	**Credits**	**: 3**
L: T: P: S:	**: 3: 0: 0: 0:**	**CIE Marks:**	**50**
Exam Hours:	**: 3**	**SEE Marks:**	**50**

Course Outcomes:	**At the end of the Course, the Student will be able to:**
CO#	**COURSE OUTCOME**
20AIM653A.1	Implement client-server applications and TCP/IP socket programs
20AIM653A.2	Analyze the need for advanced Java concepts like enumerations and collections in developing modular and efficient programs
20AIM653A.3	Design solutions using maps and comparators
20AIM653A.4	Evaluate how servlets fit into Java-based web application architecture
20AIM653A.5	Use JDBC API to demonstrate database access and details for managing information

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM653A.1	-	-	-	-	3	-	-	-	-	-	-	3	3	3
20AIM653A.2	-	3	-	-	3	-	-	-	-	-	-	3	3	2
20AIM653A.3	-	-	3	-	-	-	-	-	-	-	-	3	3	3
20AIM653A.4	-	-	-	3	3	-	-	-	-	-	-	3	3	3
20AIM653A.5	-	-	-	3	3	-	-	-	-	-	-	3	3	3
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)														

Module No	**Module Contents**	**Hours**	**COs**
1	Java Networking Network Basics and Socket overview, TCP/IP client sockets, URL, TCP/IP server sockets, Datagrams, java.net package Socket, ServerSocket, InetAddress, URL, URLConnection	**9**	**CO1**
2	Enumerations, Autoboxing and Annotations Enumerations, Enumeration fundamentals, the values() and valueOf() Methods, java enumerations are class types, enumerations Inherits Enum, example, type wrappers, Autoboxing, Autoboxing and Methods, Autoboxing/Unboxing occurs in Expressions, Autoboxing/Unboxing, Boolean and character values, Autoboxing/Unboxing helps prevent errors, A word of Warning. Annotations, Annotation basics, specifying retention policy, Obtaining Annotations at run time by use of reflection, Annotated element Interface	**9**	**CO2**
3	The collections and Framework The collections and Framework: Collections Overview, Recent Changes to Collections, The Collection Interfaces, The Collection Classes, Accessing a collection Via an Iterator, Storing User Defined Classes in Collections, The Random Access Interface, Working With Maps, Comparators, The Collection Algorithms, Why Generic Collections?, The legacy Classes and Interfaces, Parting Thoughts on Collections.	**9**	**CO2, CO3**
4	Background Background; The Life Cycle of a Servlet; Using Tomcat for Servlet	**9**	**CO4**

	Development; A simple Servlet; The Servlet API; The Javax.servlet Package; Reading Servlet Parameter; The Javax.servlet.http package Handling HTTP Requests and Responses; Using Cookies; Session Tracking. Java Server Pages (JSP): JSP, JSP Tags, Tomcat, Reques String, User Sessions, Cookies, Session Objects		
5	The Concept of JDBC The Concept of JDBC; JDBC Driver Types; JDBC Packages; A Brie Overview of the JDBC process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; ResultSet Transaction Processing; Metadata, Data types; Exceptions.	**9**	**CO4, CO5**

Text Books:

1. Herbert Schildt: JAVA the Complete Reference, 7th/9th Edition, Tata McGraw Hill, 2007.
2. Jim Keogh: J2EE-TheCompleteReference, McGraw Hill, 2007.

Reference Books:

1. Y. Daniel Liang: Introduction to JAVA Programming, 7thEdition, Pearson Education, 2007.
2. Stephanie Bodoff et al: The J2EE Tutorial, 2nd Edition, Pearson Education,2004.

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests (25 marks)	Assignment 1 (7.5 Marks)	Assignment 2 (7.5Marks)	Quiz1 (05Marks)	Quiz2 (05 Marks)
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	5	-	-	-	-
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

SEE- Semester End Examination (50Marks)

Bloom's Category	Questions (50 marks)
Remember	10
Understand	10
Apply	20
Analyze	10
Evaluate	-
Create	-

BLOCK CHAIN TECHNOLOGY

Course Code	**: 20AIM654A**	**Credits**	**: 3**
L: T: P: S:	**: 3: 0: 0: 0:**	**CIE Marks:**	**50**
Exam Hours:	**: 3**	**SEE Marks:**	**50**

Course Outcomes:	**At the end of the Course, the Student will be able to:**
CO#	**COURSE OUTCOME**
20AIM654A.1	Understand the basic concepts and technology used for blockchain.
20AIM654A.2	Develop Ethereum block chain contract.
20AIM654A.3	Apply security features in blockchain technologies
20AIM654A.4	Analyze the primitives of the distributed computing and cryptography related to blockchain.
20AIM654A.5	Use Bitcoin Scripting language for secure transaction.

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM654A.1	3	-	-	-	-	-	-	-	-	-	-	3	3	3
20AIM654A.2	3	-	3	-	-	-	-	-	-	-	-	3	3	3
20AIM654A.3	3	-	-	-	-	-	-	-	-	-	-	3	3	3
20AIM654A.4	-	3	-	-	3	-	-	-	-	-	-	3	3	2
20AIM654A.5	-	-	-	3	3	-	-	-	-	-	-	3	3	3

Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)

Module No	Module Contents	Hours	COs
1	**Introduction:** Need for Distributed Record Keeping, Modeling faults and adversaries, Byzantine Generals problem, Consensus algorithms and their scalability problems, Nakamoto's concept with Blockchain based cryptocurrency, Technologies Borrowed in Blockchain – hash pointers, consensus, byzantine fault-tolerant distributed computing, digital cash etc.	**9**	**CO1**
2	**Basic Distributed Computing & Crypto primitives:** Atomic Broadcast, Consensus, Byzantine Models of fault tolerance, Hash functions, Puzzle friendly Hash, Collison resistant hash, digital signatures, public key crypto, verifiable random functions, Zero-knowledge systems. .	**9**	**CO2, CO3, CO4**
3	**Bitcoin basics:** Bitcoin blockchain, Challenges and solutions, proof of work, Proof of stake, alternatives to Bitcoin consensus, Bitcoin scripting language and their use.	**9**	**CO3, CO5**
4	**Ethereum basics:** Ethereum and Smart Contracts, The Turing Completeness of Smart Contract Languages and verification challenges, Using smart contracts to enforce legal contracts, comparing Bitcoin scripting vs. Ethereum Smart Contracts, Writing smart contracts using Solidity & JavaScript.	**9**	**CO2, CO4, CO5**
5	**Privacy, Security issues in Blockchain:** Pseudo-anonymity vs. anonymity, Zcash and Zk-SNARKS for anonymity preservation, attacks on Blockchains: Sybil attacks, selfish mining, 51% attacks advent of algorand; Sharding based consensus algorithms to prevent these attacks.	**9**	**CO3**

Text Books:

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

Reference Books:

1. Imran Bashir, "Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained", Packt Publishing.
2. Merunas Grincalaitis, "Mastering Ethereum: Implement Advanced Blockchain Applications Using Ethereum-supported Tools, Services, and Protocols", Packt Publishing.

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests (25 marks)	Assignment 1 (7.5 Marks)	Assignment 2 (7.5Marks)	Quiz1 (05Marks)	Quiz2 (05 Marks)
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	5	-	-	-	-
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

SEE- Semester End Examination (50Marks)

Bloom's Category	Questions (50 marks)
Remember	10
Understand	10
Apply	20
Analyze	10
Evaluate	-
Create	-