BE SCHEME & SYLLABUS

Third Year (V and VI Semester)

With effect from 2022-23

Artificial Intelligence & Machine Learning



ST JOSEPH ENGINEERING COLLEGE

AN AUTONOMOUS INSTITUTION Vamanjoor, Mangaluru - 575028



Service & Excellence

VISION

To be a global premier Institution of professional education and research.

MISSION

- Provide opportunities to deserving students of all communities, the Christian students in particular for quality professional education.
- Design and deliver curricula to meet the national and global changing needs through student-centric learning methodologies.
- Attract, nurture and retain the best faculty and technical manpower.
- Consolidate the state-of-art infrastructure and equipment for teaching and research activities.
- Promote all round personality development of the students through interaction with alumni, academia and industry.
- Strengthen the Educational Social Responsibilities (ESR) of the institution.



ST JOSEPH ENGINEERING COLLEGE

An Autonomous Institution Vamanjoor, Mangaluru - 575028

Affiliated to VTU – Belagavi & Recognized by AICTE New Delhi NBA – Accredited: B.E.(CSE, ECE, EEE, ME and CIV) & PG (MBA and MCA) NAAC – Accredited with A+

> B.E. SCHEME & SYLLABUS (With effect from 2022-23)

Artificial Intelligence and Machine Learning

THIRD YEAR

(V and VI Semester)

AUTONOMY AND ACCREDITATION

St Joseph Engineering College (SJEC) is an Autonomous Institute under Visvesvaraya Technological University (VTU), Belagavi, Karnataka State, and is recognized by the All-India Council for Technical Education (AICTE), New Delhi. SJEC is registered under the trust "Diocese of Mangalore, Social Action Department".

The SJEC has been conferred Fresh Autonomous Status from the Academic Year 2021-22. The college was granted autonomy by the University Grants Commission (UGC) under the UGC Scheme for Autonomous Colleges 2018 and conferred by VTU. The UGC Expert Team had visited the college on 28-29 November 2021 and rigorously assessed the college on multiple parameters. The fact that only a handful of engineering colleges in the state have attained Autonomous Status adds to the college's credibility that has been on a constant upswing. Autonomy will make it convenient for the college to design curricula by recognizing the needs of the industry, offering elective courses of choice and conducting the continuous assessment of its students.

At SJEC, the Outcome-Based Education (OBE) system has been implemented since 2011. Owing to OBE practised at the college, SJEC has already been accredited by the National Board of Accreditation (NBA). Five of the UG programs, namely Computer Science & Engineering, Mechanical Engineering, Electronics and Communication Engineering, Electrical & Electronics Engineering and Civil Engineering and two of the PG programs, namely, MBA and MCA programs, have accreditation from the NBA.

Also, SJEC has been awarded the prestigious A+ grade by the National Assessment and Accreditation Council (NAAC) for five years. With a Cumulative Grade Point Average (CGPA) of 3.39 on a 4-point scale, SJEC has joined the elite list of colleges accredited with an A+ grade by NAAC in its first cycle. The fact that only a small percentage of the Higher Education Institutions in India have bagged A+ or higher grades by NAAC adds to the college's credibility that has been on a constant upswing.

The college is committed to offering quality education to all its students, and the accreditation by NAAC and NBA reassures this fact. True to its motto of "Service and Excellence", the college's hard work has resulted in getting this recognition, which has endorsed the academic framework and policies that the college has been practicing since its inception. The college has been leveraging a flexible choice-based academic model that gives students the freedom to undergo learning in respective disciplines and a transparent and continuous evaluation process that helps in their holistic development.

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ABOUT THE DEPARTMENT

Artificial Intelligence (AI) and Machine Learning (ML) are being looked as the drivers for the next industrial revolution happening in the world today. Artificial Intelligence has been utilized in various fields like Medicine, Language processing, Finance, Education, Transportation, Business, Law and more.

Artificial Intelligence is the branch of Computer Science that emphasizes the development of intelligent machines which think and work like humans. With the advancement in technology, we are already connected to AI in one way or the other – whether it is Siri, Watson or Alexa. More and more companies are investing resources in Machine Learning (ML), indicating a robust growth in AI products and apps in the near future.

AI and ML are integral parts of data science, where techniques from both such as regression, predictive analytics and more are applied for insight generation. Job Opportunities for AI & ML engineers such as - Business Intelligence Developer, Research Scientist, Full stack developer, Software architect, Data analyst, Data warehouse engineer and Product manager are highly demanding. Demand for AI and ML engineers is projected to be 1,25,00 in the next five years.

The four-year engineering course in AI and ML at SJEC offers subjects like Introduction to Sensors, ML with Python, Big Data Analytics, Natural Language Processing (NLP), Applied Statistics, Expert System, Fuzzy Logic, Virtual Reality, Robotics Process Automation (RPA), Internet of Things (IoT), Speech Processing, Computation Intelligence, Pervasive Computing, Knowledge and Data Engineering, ML and AI for Healthcare & Agriculture, Deep Learning, Game Theory, etc.

DEPARTMENT VISION

To impart value-based quality education with the motive of transforming mankind with excellence and competing areas of engineering, technology and management.

DEPARTMENT MISSION

- 1. Focus on the practical aspects of the curriculum to make learning a meaningful and interesting experience.
- 2. Encourage active collaboration with industries, communities, and fellow institutions within the country and abroad.
- 3. Infuse strong moral and ethical principles in students in order to make them conscientious citizens and excellent human beings.
- 4. Cultivate the competitive spirit required for success.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

- 1. To provide students with a solid foundation and the ability to use engineering concepts, mathematics, physics, and humanities required to develop, analyse, design, and implement solutions to the problems in intelligent computing and business systems.
- 2. To develop in students, the knowledge of computer science and engineering to work in domains such as artificial intelligence, machine learning and data science.
- 3. To foster in students, the capacity of teamwork through efficient communication in multidisciplinary projects.
- 4. To prepare students for building successful careers in artificial intelligence, data science and business systems to meet the needs of society while incorporating professional ethics.
- 5. To inspire learners to pursue higher education in their desired fields and engage in research.

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

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

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

3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Conduct investigations on complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and the synthesis of information to provide valid conclusions.

5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

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

11. 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 a leader in a team, to manage projects and in multidisciplinary environments.

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

PROGRAM SPECIFIC OUTCOMES (PSOs)

- 1. **Entrepreneurship and Freelancing**: Recognize the tenets of entrepreneurship, freelancing and the prerequisites for starting a business in the IT or related fields.
- 2. **Competitive Exams**: Participate skillfully in competitive examinations for certification, professional advancement, and admission to higher studies.

	V Semester (B.E Artificial Intelligence & Machine Learning)												
						T Ho	eachin urs/We	g eek]	Examiı	nation		
SI. No.	SI. Course and Course No. Code		Course Title caching		ıper Setting ard	Theory Lecture	Tutorial	Practical/ Drawing)uration in hours	CIE Marks	EE Marks	otal Marks	Credits
				De	Pa Bo	L	Т	Р	Π)	S	L	
1	HSMC	22AIM51	Software Engineering and Project Management	AIM	AIM	3	-	-	03	50	50	100	3
2	IPCC	22AIM52	Computer Networks (Integrated)	AIM	AIM	3	-	2	03	50	50	100	4
3	IPCC	22AIM53	Fundamentals of AI and ML (Integrated)	AIM	AIM	3	-	2	03	50	50	100	4
4	PCC	22AIM54	Theory of Computation	AIM	AIM	2	2	-	03	50	50	100	3
5	PCCL	22AIM55L	Data Visualization Laboratory	AIM	AIM	-	-	2	03	50	50	100	1
6	PEC	22AIM56X	Professional Elective - I	AIM	AIM	3	-	-	03	50	50	100	3
7	AEC/SDC	22RMI57	Research Methodology and Intellectual Property Rights	COM	COM	2	-	-	03	50	50	100	2
8	AEC/SDC	22ETP58	Emerging Technologies: A Primer	COM	COM	-	-	2	03	100	-	100	1
					Total	16	2	8	24	450	350	800	21

	22AIM56X :	Professional Elective	I	
22AIM561	Data Mining and Data Warehousing	22AIM563	Cryptography and Cyber Security	
22AIM562	Full Stack Development	22AIM564	Business Intelligence	

	VI Semester (B.E Artificial Intelligence & Machine Learning)												
						Te Hou	achi rs/V	ng Veek	Examination				
SI. No.	Course a C	nd Course ode	Course Title	'eaching)epartment	aper Setting oard	Theory Lecture	Tutorial	Practical/ Drawing	uration in ours	JE Marks	EE Marks	otal Marks	redits
	maa					L	Τ	P	P P	0	S	H	
1	IPCC	22AIM61	Digital Image Processing (Integrated)	AIM	AIM	3	-	2	03	50	50	100	4
2	IPCC	22AIM62	Advanced AI and ML (Integrated)	AIM	AIM	3	-	2	03	50	50	100	4
3	PCC	22AIM63	Natural Language Processing	AIM	AIM	3	-	-	03	50	50	100	3
4	PEC	22AIM64X	Professional Elective -II	AIM	AIM	3	-	-	03	50	50	100	3
5	OEC	22AIM65X	Open Elective -I	AIM	AIM	3	-	-	03	50	50	100	3
6	PRJ	22AIM66	Major Project Phase - I	AIM	AIM	-	-	4	03	100	_	100	2
7	HSMC	22CIV67	Environmental Studies	CIV	CIV	1	-	-	02	50	50	100	1
8	AEC/SDC	22IIP68	Innovation and Intellectual Property	COM	COM	-	-	2	03	100	_	100	1
	Total							10	23	500	300	800	21

22AIM64X : Professional Elective II								
22AIM641	Robotic Process Automation	22AIM643	Predictive Analytics					
22AIM642	Blockchain Technology	22AIM644	High Performance Computing					

22AIM65X: Open Elective I								
22AIM651	Introduction to AI and ML	22AIM653	Introduction to Computer Vision					
22AIM652	Introduction to Data Science	22AIM654	Predictive Analytics					

V Semester

Software Engineering and Project Management									
Course Code	22AIM51	CIE Marks	50						
Course Type	Theorem	SEE Marks	50						
(Theory/Practical/Integrated)	Theory	Total Marks	100						
Teaching Hours/Week (L:T:P)	3:0:0	SEE	3 Hours						
Total Hours	40 Hours	Credits	03						

- Understand the fundamental principles of software project management.
- Have a good knowledge of responsibilities of project manager.
- Be familiar with the different methods and techniques used for project management.
- Implement a software project management activity and complete a specific project in time with the available budget.

Module-1 Introduction (8 hours)

Introduction: Defining of Software Development Process - Process – Software engineering ethics, Software Process Models: Waterfall Model, Prototyping Model, RAD Model, Incremental Model, Spiral Model, Component Assembly Model - Software Life Cycle, Process activities, coping with change.

TB1: Ch 1, 2

Module-2 Agile Software Development (8 hours)

Agile Software Development: Agile methods, Agile project management, scaling agile methods. Requirements engineering: Functional and non-functional requirements. Requirements specification, validation, management. System modelling: models, model driven engineering, Architectural design: views, patterns, architectures.

TB1: Ch 3,4,5,6

Module-3 Software Design, Implementation, Testing and Evolution (8 hours)

Design and Implementation: Object-oriented design using the UML, Design patterns, Implementation issues, Open-source development. **Software Testing:** Development testing, Testdriven development, Release Testing, User Testing **Testing**: Testing concepts, Testing process, Black-Box Testing, White-Box Testing, Metrics

TB1: Ch 7, 8, TB2: Ch 8

Module-4 Project Management, Planning, Tracking and Reporting (8 hours)

Project management: Risk Management, managing people, Teamwork **Project Planning:** Software pricing, Plan-driven development, Project scheduling, Agile planning, Estimation Techniques, COCOMO cost modelling **Project tracking and reporting:** Introduction, Project Execution, Monitoring and Controlling Project Work, Project Performance Reports.

TB1: Ch 20, 23 TB3: Ch 19

Module-5 Project Quality, Configuration Management and Closure (8 hours)

Quality Management: Software quality, Software standards, Reviews and inspections, Quality Management and agile development, Software measurement. **Configuration Management:** Version management, System building, Change management, Release Management. **Project Closure:** Introduction, why? Acceptance Closure, Major activities in Close Project, Administrative and Contract closure, Project closure process, Project Termination, Closure Analysis, Final closure report.

TB1: Ch 24, 25 TB3: Ch 20

Course Outcomes: At the end of the course the student will be able to:								
22AIM51.1	Identify the appropriate software process model suited to the type of software to be developed.							
22AIM51.2	Select team members for a team suited to execute a software project.							

22 A IM 51 3	Prepare UML design diagrams by incorporating implementation considerations
22AIIVI31.3	and use test cases for its validation process.
22AIM51.4	Identify the factors used to manage, plan, track and reporting of the project
22AIM51 5	Analyze the significance of software quality and configuration management prior
22AINI31,3	to the closure of project.
22 A IM 51 6	Build a project by incorporating appropriate software model, team members,
22A119131.0	design diagrams and project management techniques.

Sl.	Title of the Book	Name of the	Name of the	Edition and Year
No.		Author/s	Publisher	
Text	books			
1	Software Engineering	Ian Sommerville	Pearson	9 th Edition, 2017
2	Software Engineering	Pankaj Jalote	Wiley India	1 st Edition, 2024
	A Precise Approach			
3	Software Project	Saikat Dutt /S.	Pearson	1 st Edition, 2015
	Management	Chandramouli		
Refer	ence Books			
1	Software Engineering	Roger S	McGraw Hill	7 th Edition
		Pressman	publication.	
2	Information Technology	Kathy Schwalbe	Cengage Learning	7 th Edition,2013
	Project management		Publication.	
3	Software Engineering	Richard H. Thayer	Wiley India	2 nd Edition, 2006
	Project Management		Publication.	

- https://www.youtube.com/playlist?list=PLYwpaL_SFmcCB7zUM0YSDR-1mM4KoiyLM
- https://www.youtube.com/watch?v=w9BSk8MGOGM
- <u>https://www.youtube.com/watch?v=bXLTxa7wBO0</u>
- <u>https://www.youtube.com/watch?v=0RmBrKxwCz8</u>
- <u>https://www.coursera.org/lecture/software-engineering-software-design-and-project-management/lecture-6-1-project-management-3fFjd</u>
- https://www.youtube.com/watch?v=zem9u4-99RM
- https://www.youtube.com/watch?v=PnDqi7ISdOQ

Course Articulation Matrix

Course		Program Outcomes (POs)													
Outcomes (COs)	P01	P02	P03	P04	P05	P06	P07	PO8	P09	P010	P011	P012	PSO1	PSO2	
22AIM51.1					2								2	1	
22AIM51.2			3				2								
22AIM51.3			2			1	2								
22AIM51.4							1			1					
22AIM51.5			3							2			2	1	
22AIM51.6								1	1				2	1	

Computer Networks									
Course Code	22AIM52	CIE Marks	50						
Course Type	Interneted	SEE Marks	50						
(Theory/Practical/Integrated)	Integrated	Total Marks	100						
Teaching Hours/Week (L:T:P)	3:0:2	SEE	3 Hours						
Total Hours	40 hours Theory + 10 Lab slots	Credits	04						

- Comprehend the transmission technique of digital data between multiple computers
- Understand the fundamentals of data communication networks.
- Analyze the applications of various network core devices and protocols in data communication.
- Explain routers, IP and Routing Algorithms in network layer
- Implement different protocols and analyze the network performance.

Module-1: Introduction (8 hours)

Uses of computer networks: Business Applications, Home Application, Mobile Users, Social Issues; Network hardware: Local Area Networks, Metropolitan Area Networks, Wide Area Networks, Wireless Networks, Home Networks, Internet works; Network software: Protocol Hierarchies, Design Issues for the Layers, Connection-Oriented and Connectionless Services, Service Primitives. Reference Models: OSI Reference Model and TCP/IP Reference Model. **TB1**

Module-2: Physical Layer & Data Link Layer (8 hours)

Physical Layer: Data and Signals, Digital Signals, Transmission Impairment, Data Rate limits, Performance, Digital to digital conversion (Only Line coding: Polar, Bipolar and Manchester coding), Analog to digital conversion (only PCM), Transmission Modes, Digital to analog conversion. **Introduction to Data-Link Layer**: Introduction, DLC services, Data link layer protocols, Point to Point protocol (Framing, Transition phases only), Link-Layer Addressing, ARP **Switching**: Introduction, Circuit Switched Networks and Packet switching. **Error Detection and Correction:** Introduction, Block coding, Cyclic codes

TB2

Module-3: Network Layer (8 hours)

Routing algorithms: The Optimality Principle, Shortest Path Routing, Flooding, Distance Vector Routing, Link state Routing, Hierarchical Routing, Broadcast Routing, Multicast Routing, Routing for Mobile Hosts, Routing in Ad hoc Networks. Congestion Control Algorithms: General Principles of Congestion Control, Congestion Prevention Policies The Network Layer in the Internet: The IPv4 Protocol, IP Addresses, subnets, CIDR-Classless Inter Domain Routing, Mobile IP, IPv6, IPv6 Header. **TB1**

Module-4: Transport Layer (8 hours)

Introduction: Transport-Layer Services, Connectionless and Connection-Oriented Protocols, User Datagram Protocol: User Datagram, UDP Services, UDP Applications, Transmission Control Protocol, TCP Services, TCP Features, Segment, A TCP Connection, State Transition Diagram, Windows in TCP, Flow Control, Error Control, TCP Congestion Control **TB2**

Module-5: Application Layer (8 hours)

Introduction, Client-Server Programming using TCP and UDP, World Wide Web, HyperText Transfer Protocol (HTTP), FTP, Electronic Mail, Domain Name System (DNS): Name Space, DNS in the Internet, Resolution, Caching, Resource Records, DNS Messages **TB2**

PRACTICAL MODULE

- 1. Network System Administration: Understanding the basic network configuration and installation.
- 2. Implement a Python Program to print host name and IP address of local host.
- 3. Implement a Python Program to print host name and IP address of remote host where IP address of remote host is available.
- 4. Implement a TCP based client server program in python using TCP sockets where Server displays the following:
 - a. Host Name, IP address and Port Number on which it is hosted
 - b. IP address and port number of a client requesting connection. Server sends the message "Thanks for Connecting!" back to client. Client displays this message on screen.
- 5. Implement a UDP based client server program in python using UDP sockets where Server displays the following:
 - a. Host Name, IP address and Port Number on which it is hosted
 - b. IP address and port number of a client sending some dummy message. Server displays the dummy message on screen. Server sends the message "Thanks for Message!" back to client. Client displays this message on screen.
- 6. Write a program in Java/Python to find the shortest path between vertices using Distance-Vector (DV) Routing Algorithm.
- 7. Write a program in Java/Python for error detection code using CRC-CCITT(16 bits).
- 8. Write a program in Java/Python to implement congestion control using Leaky Bucket algorithm.

OPEN ENDED EXPERIMENT

- 1. Perform Network Analysis using Packet Tracer/Wireshark tool.
- 2. Implement packet sniffer using any programming language.

Course Outcon	nes: At the end of the course the student will be able to:
22AIM52.1	Explain the fundamental principles involved in data communication
22AIM52.2	Describe the fundamental concepts involved in physical layer, different switching mechanisms and data link layer protocols for digital communication
22AIM52.3	Discuss the working of routing protocols, the entities involved in the day to day running of the cellular networks and the process involved with development ofpolicy and protocols of these networks.
22AIM52.4	Identify the essential principles of a transport layer protocol and explain how they are used to solve computer networking problems.
22AIM52.5	Apply the basic concepts of networking to explain the principles of applicationlayer protocols and select appropriate protocols for a particular scenario
22AIM52.6	Analyze the current architecture of the internet and the entities involved in theday to day running of the internet using modern networking tools.

Sl No	Title of the Book	Name of the Author/s		ne of the lisher	Edition and Year
Te	extbooks				
1	Computer Networks	Andrew S. Tanenbaum David J. Wetherall		Pearson	6 th Edition, 2021
2	Data Communications and Networking	Behrouz A. Forouz	an	Tata McGraw-Hill	6 th Edition, 2022

Re	Reference Books											
1	Computer Networking, A	James F Kurose and	Pearson	6 th Edition,								
	Top-Down Approach	Keith W Ross		2017								
2	Computer Networks	Larry L Peterson and	ELSEVIER	6 th Edition,								
		Brusce S Davie		2020								
3	Computer Networks	Mayank Dave	Cengage	1 st Edition,								
			Learning	2012								

- Computer Networks and Internet Protocol, IIT Kharagpur: https://www.youtube.com/playlist?list=PLbRMhDVUMngf-peFloB7kyiA40EptH1up
- TCP/IP Tutorial and Technical Overview: https://www.redbooks.ibm.com/redbooks/pdfs/gg243376.pdf
- RFCs: <u>http://www.ietf.org/rfc.html</u>
- Computer Networks: <u>https://www.cse.iitk.ac.in/users/dheeraj/cs425/</u>
- Web Resources for Computer Networks, 5/e: https://www.cs.vu.nl/~ast/CN5/https://nptel.ac.in/courses/106105081
- <u>https://docs.python.org/3/howto/sockets.html</u>
 - <u>https://docs.python.org/3/library/socket.html</u>

Course					F	Progra	ım Ou	tcome	es (PO	s)				
(COs)	P01	P02	P03	P04	P05	P06	P07	P08	P09	PO10	P011	P012	PSO1	PSO2
22AIM52.1	3		1											1
22AIM52.2	3													
22AIM52.3		1	2											
22AIM52.4	2		1											
22AIM52.5		1	3											
22AIM52.6					3				1		1		1	2

Course Articulation Matrix

Fundamentals of AI and ML										
Course Code	22AIM53	CIE Marks	50							
Course Type	Integrated	SEE Marks	50							
(Theory/Practical/Integrated)	Integrated	Total Marks	100							
Teaching Hours/Week (L:T:P)	3:0:2	SEE	3 Hours							
Total Hours	40 hours Theory + 10 Lab slots	Credits	04							

- Gain a historical perspective of AI and its foundations.
- Become familiar with basic principles of AI toward problem solving.
- Define Machine Learning (ML) and its significance in AI.
- Understand the basics of Decision Tree and Introduce Reinforcement Learning (RL) and its components.
- Learn about Bayes' theorem and its application in concept learning.

Module-1 Introduction to AI (8 hours)

What is AI, The foundation of Artificial Intelligence, The history of Artificial Intelligence, Intelligent Agents: Agents and Environments, Good Behavior: The concept of rationality, the nature of Environments, the structure of Agents.

TB1: Ch-1, 2

Module-2 Search Strategies (8 hours)

Problem solving agents, Example problems, Searching for solutions, Uninformed search strategies, Informed search strategies, Heuristic functions

TB 1: Ch- 3

Module-3 Introduction to Machine Learning (8 hours)

Introduction: Machine learning Landscape: what is ML? Why, Types of ML, main challenges of ML. Concept Learning: Concept learning task, Concept learning as search, Find-S algorithm, Candidate Elimination Algorithm, Inductive bias of Candidate Elimination Algorithm.

TB 2: Ch-1, 2

Module-4 Decision Trees and Reinforcement Learning (8 hours)

Decision Tree Learning: Introduction, Decision tree representation, Appropriate problems, ID3 algorithm.Reinforcement Learning: Introduction, The learning task, Q-Learning **TB 2: Ch- 3, 13**

Module-5 Bayesian Learning (8 hours)

Bayesian Learning: Introduction, Bayes theorem, Bayes theorem and concept learning, MDL principle, Bayes optimal classifier, Gibbs algorithm, Naive Bayes classifier, BBN, EM Algorithm. **TB 2: Ch-6**

PRACTICAL MODULE

- 1. Write a Program to Implement simple Chatbot with minimum 10 conversations
- 2. Write a Program to Implement and Demonstrate Water Jug Problem.
- 3. Write a Program to Implement A* Algorithm.
- 4. Write a Program to Solve 8-Queens Problem with suitable assumptions.
- 5. Develop an interactive program to compare the working of FIND-S algorithm and LIST THEN ELIMINATE algorithm. Consider training data examples stored in Bitcoin_Prices dataset.
- 6. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm. Output a description of the set of all hypothesesconsistent with the training examples.
- 7. Demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
- Implement the naïve Bayesian classifier for a sample training data set stored as a NEET UG RESULTS DATASET.CSV file. Compute the accuracy of the classifier, considering few test data sets.

OPEN ENDED EXPERIMENT

1. Develop a machine learning model for classification task using a suitable dataset and evaluate its performance with various evaluation metrics.

Course Outcom	Course Outcomes: At the end of the course, the student will be able to:								
22AIM53.1	Describe the fundamental concepts of Artificial Intelligence.								
22AIM53.2	Demonstrate Various Search and Heuristic techniques.								
22AIM53.3	Apply Machine Learning concepts and Implement Basic machine learning algorithms.								
22AIM53.4	Apply decision tree and reinforcement learning technique for a given problem scenario.								
22AIM53.5	Apply Bayesian Rule for a given problem scenario.								
22AIM53.6	Analyze the techniques of AI & ML for specific applications.								

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Text	books			
1	Artificial Intelligence	icial Intelligence Stuart J. Russell and Peter Norvig		3 rd Edition, 2015
2	Machine Learning	Tom Mitchell	McGraw Hill Publication	1 st Edition, 2013
Refei	ence Books			
1	Artificial Intelligence Structure and Strategies	George F Luger	Pearson Education	3 rd Edition, 2000

Web links and Video Lectures(e-Resources):

- Artificial Intelligence Overview (tutorialspoint.com)
- <u>Problem-solving in Artificial Intelligence TAE (tutorialandexample.com)</u>
- Decision Tree Tutorials & Notes | Machine Learning | HackerEarth
- <u>History of Artificial Intelligence Javatpoint</u>
- <u>Heuristic Search Techniques in Artificial Intelligence TechVidvan</u>
- <u>http://14.139.161.31/OddSem-0822-1122/Hands-On Machine Learning with Scikit-</u> Learn Keras-and-TensorFlow-2nd-Edition-Aurelien-Geron.pdf
- <u>https://www.studocu.com/in/document/jawaharlal-nehru-technological-university</u> hyderabad/machine-learning/machine-learning-lab-manual-part-1/55275690
- <u>https://www.studocu.com/in/document/duquesne-university/computer-programming-c/6cs4- 22-</u> <u>machine-learning-lab-manual/13932038</u>
- <u>https://intellipaat.com/blog/machine-learning-python-tutorial</u>
- <u>https://www.coursera.org/learn/machine-learning-with-python</u>

Course Articulation Matrix

Course	Program Outcomes (POs)													
(COs)	P01	P02	P03	P04	P05	P06	P07	P08	60d	P010	P011	P012	PS01	PSO2
22AIM53.1	1	2	2										1	
22AIM53.2		2											1	2
22AIM53.3		2			1								2	1
22AIM53.4		2			2								2	1
22AIM53.5	2	2	2		2								2	
22AIM53.6	2	2			1								2	

1: Low 2: Medium 3: High

	Theory of Computation		
Course Code	22AIM54	CIE Marks	50
Course Type	Theory	SEE Marks	50
(Theory/Practical/Integrated)	Theory	Total Marks	100
Teaching Hours/Week (L: T:P)	2:2:0	SEE	3 Hours
Total Hours	40 hours	Credits	03

- Introduce core concepts in Automata and Theory of Computation
- Identify different Formal language Classes and their Relationships.
- Design Grammars and Recognizers for different formal languages.
- Prove or disprove theorems in automata theory using their properties.
- Determine the decidability and intractability of Computational problems

Module-1: Introduction to Automata (8 hours)

Why study the Theory of Computation: Applications, Languages and Strings: Strings, Languages. A Language Hierarchy: Machine Based and Computational based Hierarchy, Finite State Machines (FSM): Deterministic FSM, Regular languages, Designing FSM, Nondeterministic FSMs, Minimizing FSMs, Transducers TR1:Ch 1 2 3 5

TB1:Ch 1, 2, 3, 5

Module-2: Regular Expression and Regular Languages (8 hours)

Regular Expressions (RE): What is a RE?, Kleene's theorem, **Regular Grammars:** Definition, Regular Grammars and Regular languages. **Regular Languages (RL) and Nonregular Languages:** Closure properties of RLs, to show that a language is not regular. **TB1:Ch 6.1 to 6.2, Ch 7.1,7.2, Ch 8.3 to 8.4**

Module-3: Introduction to CFG's(8 hours)

Context-Free Grammars (CFG): Introduction to Rewrite Systems and Grammars, CFGs and languages, designing CFGs, simplifying CFGs, proving that a Grammar is correct. Derivation and

languages, designing CFGs, simplifying CFGs, proving that a Grammar is correct, Derivation and Parse trees, Ambiguity, Normal Forms.

Pushdown Automata (PDA): Definition of non- deterministic PDA, Deterministic and Non-deterministic PDAs

TB1:Ch 11.1 to 11.8, 12.1, 12.2

Module-4: Turing Machines (8 hours)

Algorithms and Decision Procedures for CFLs: Decidable questions, Undecidable questions. Turing Machine: Turing machine model, Representation, Language acceptability by TM, design of TM, Techniques for TM construction. Variants of Turing Machines (TM), The model of Linear Bounded automata. TB1:Ch 14.1, 14.2, TB2:Ch 9.1 to 9.8.

Module-5: Decidability (8 hours)

Decidability: Definition of an algorithm, decidability, decidable languages, Undecidable languages, halting problem of TM, Post correspondence problem.

Complexity: Growth rate of functions, the classes of P and NP, Quantum Computation: quantum computers, Church-Turing thesis. **TB2: Ch 10.1 to 10.7, 12.1, 12.2, 12.8.**

Course Outco	mes: At the end of the course the student will be able to:
22AIM54.1	Demonstrate the core concepts of automata theory using Finite State Machines.
22AIM54.2	Show equivalence between regular expressions and FSMs using theirproperties.
22AIM54.3	Write grammars and Push Down Automata for different languages.
22AIM54.4	Solve problems using formal models like Turing Machines.
22AIM54.5	Examine the decidable, undecidable problems and their associated complexity
	classes
22AIM54.6	Analyze formal models for specific problem scenarios.

Sl.	Title of the Book	Name of the	Name of the	Edition and	
No.	The of the book	Author/s	Publisher	Year	
Textbo	ooks				
1	Automata, computability and Complexity	Elaine Rich	Pearson Education	1 st Edition, 2013	
2	Theory of Computer Science	K L P Mishra, N Chandrasekaran	Prentice Hall India Learning Pvt Ltd	3 rd Edition, 2012	
Refere					
1	Introduction to AutomataJ.P. Hopcroft,Theory, Languages andRajeev Motwani,Computationand J.D. Ullman		Pearson Education	3 rd Edition, 2000	
2	Introduction to the Theory of Computation	Michael Sipser	Cengage learning	3 rd Edition, 2014	
3	Formal Languages and Automata theory	ormal Languages and Basavaraj. Anami, Wiley India Wiley India		1 st Edition, 2012	
4	Formal Languages and Automata Theory	ormal Languages and utomata Theory C K Nagpal		1 st Edition, 2012	

- https://nptel.ac.in/courses/106/104/106104028/
- <u>https://www.youtube.com/watch?v=Zs5XvkYm-9E</u>
- <u>https://www.youtube.com/watch?v=xGvp0SP-PnU</u>
- https://www.youtube.com/watch?v=2uf5Ph9NOS0
- https://www.youtube.com/watch?v=PvLaPKPzq2I

Course Articulation Matrix

Course		Program Outcomes (POs)												
Outcomes (COs)	P01	P02	PO3	P04	PO5	PO6	P07	PO8	909	PO 10	P011	PO 12	PSO 1	PSO 2
22AIM54.1	2	2												1
22AIM54.2	2			1										
22AIM54.3			2											2
22AIM54.4	2	2												
22AIM54.5				2										
22AIM54.6				3										2

1: Low 2: Medium 3: High

Data Visualization Laboratory						
Course Code	22AIM55L	CIE Marks	50			
Course Type	Proctical	SEE Marks	50			
(Theory/Practical/Integrated)	Tacucal	Total Marks	100			
Teaching Hours/Week (L: T:P)	0:0:2	SEE	3 Hours			
Total Hours	10 Lab Slots	Credits	01			
Course Learning Objectives: The ol	ojective of the course is to					
Understand Fundamental Data	Science Concepts					
 Develop Proliciency in Data V Apply Machine Learning Algo 	rithms					
 Develop Skills in Exploratory 	Data Analysis (EDA)					
Execute Real-world Data Proj	ects					
Laboratory Programs:						
	PART- A					
1. Create a program to analyse the	e Iris dataset using the Pan	das library in Python	. Perform data			
cleaning, data manipulation, a	nd basic statistical analysi	s to gain insights into	the dataset.			
2. Design a program to create vari	ous types of plots using the	e Matplotlib library ir	n Python using			
Titanic Dataset. Visualize dat	asets and demonstrate patt	erns andtrends.	,			
3. Develop a program with <i>Gapn</i>	<i>inder Dataset</i> , that focus	es on interactive data	a visualization			
using the Plotly library in Py	thon. Create and customi	ze interactive plots s	uch as scatter			
plots, bar charts, and heatmap	s with features like hover t	ooltipsand zoom fun	ctionalities.			
4. Create a program using the S	Scikit-Learn library in Py	thon on the Iris day	tasets.			
Implement basic supervised le	earning algorithms like lin	near regression and l	ogistic			
regression and demonstrate ba	sic machine learning conc	epts.				
5. Design a program using Sc	ikit-Learn library on Ca	lifornia Housing Pi	rices Dataset.			
evaluate model performance u	sing metrics like accuracy	precision recall an	d RMSE			
6 Develop a program using M	VIST Handwritten Digits	Dataset and implem	nent Principal			
Component Analysis (PCA) technique. Visualize	high-dimensional d	lata in lower			
dimensions.	,	8				
7. Develop a machine learning m	odel that can identify hate	tweets by preproces	sing text data,			
extracting features, training a	classifier by using the Ha	te Speech and Offens	sive Language			
Dataset and evaluate its perfor	rmance.					
8. Create a program using any So	ales/Supermarket Dataset	and implement time	series			
analysis techniques using libra	ries like Pandas and Stats	models in Python. Vi	sualizetime			
9 Develop a program to impleme	nt K-means clustering and	hierarchical clusteri	ng algorithms			
using Scikit-Learn on Iris Do	<i>staset</i> Apply these algori	thms to segment dat	a into distinct			
clusters based on similarity patterns.						
10. Create a program on the NYC	Taxi Trip Duration datase	t and demonstrate big	data analytics			
using Apache Spark, focusing	g on processing large-sca	le datasets, impleme	nting machine			
learning algorithms with Spark MLlib, and visualizing resultsusing Spark's built-in tools.						
PART- B						
With the knowledge attained	above, develop a python a	application on any s	suitabledata			
set and demonstrate data science techniques.						

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Tex	tbooks			
1	Python for Data Analysis	Wes McKinney	O'Reilly Media	2 nd Edition, 2017
Refe	rence Books			
1	Python Data Science Handbook: Essential Tools for Working with Data	Jake VanderPlas	O'Reilly Media	1 st Edition, 2016

Web links/Video Lectures/MOOCs/papers

- 1. <u>https://youtu.be/9YTNYT1maa4?si=wyTwEVgFef53ue_t</u>
- 2. https://youtu.be/17cAdp0f4X0

Course Out	comes: At the end of the course the student will be able to:
	Apply Data Manipulation Techniques to manipulate and preprocess datasets using
22AIM55L.1	appropriate techniques, including cleaning, transforming, and merging data, to
	prepare them for analysis.
	Implement Statistical Analysis and demonstrate the ability to perform
22AIM55L.2	statistical analysis on datasets and derive meaningful insights and makedata-driven
	decisions.
	Apply machine learning algorithms, including classification, regression, and
22AIM55L.3	clustering techniques, to analyze data, make predictions, and uncoverpatterns and
	relationships.
	Conduct Exploratory Data Analysis (EDA) to analyse the structure and
22AIM55L.4	characteristics of datasets, identify trends, outliers, and anomalies, and generate
	hypotheses for further analysis.
	Evaluate Model Performance to evaluate the performance of machine learning
22AIM55L.5	models using appropriate metrics and techniques, such as cross-validation, to assess
	predictive accuracy and generalization to new data.
	Compare to emerging technologies and tools in the field of data science and
22AIM55L.6	visualization, staying current with industry trends and developments
	to solve real-world problems effectively.

Course Articulation Matrix

	Program Outcomes (POs)													
Course Outcomes (COs)	P01	PO2	PO3	P04	P05	P06	P07	P08	P09	PO10	P011	P012	PSO1	PSO2
22AIM55L.1	3				2			2					2	3
22AIM55L.2		2	2		2									
22AIM55L.3		2			2				2				2	
22AIM55L.4			1		2				2			2		
22AIM55L.5			1		2						1		2	
22AIM55L.6					2	2	2			3		1		3

1: Low	2: Medium	3: High
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Data Mining and Data Warehousing							
Course Code	22AIM561	CIE Marks	50				
Course Type	Theory	SEE Marks	50				
(Theory/Practical/Integrated)	Theory	Total Marks	100				
Teaching Hours/Week (L:T:P)	3:0:0	SEE	3 Hours				
Total Hours	40 Hours	Credits	03				

• Understand the principles of Data warehousing and Data Mining.

- Be familiar with the architecture of Data warehouse and Data Mining system.
- Understand the various Data preprocessing Methods.
- Understand different supervised and unsupervised algorithms.

Module-1 Introduction (8 hours)

Why data mining, What is data mining, What kinds of data can be mined, What kinds of patterns can be mined, Which Technologies Are used, Which kinds of Applications are targeted, Major issues in data mining. Data mining applications, Data Mining and society

TB1: Ch.1.1 to 1.7, Ch.13.3

Module-2 Data Preprocessing (8 hours)

An overview, Data cleaning, Data integration, Data reduction, Data transformation and data discretization

TB1:Ch.2.1 to 2.6

Module-3 Data Warehousing and Online Analytical Processing (8 hours)

Basic concepts, Data warehouse modeling, OLAP operations, Data cube computation, Data cube computation methods

TB1: Ch.3.1 to 3.5

Module-4 Classification (8 hours)

Basic Concepts, Decision tree induction, Bayes Classification Methods, Rule-Based classification, Model evaluation and selection, Techniques to improve classification accuracy **TB1: Ch.6.1 to 6.3, 6.6, 6.7, Ch.7.4**

Module-5 Cluster Analysis (8 hours)

Cluster Analysis, Partitioning methods, Hierarchical Methods, Density-based methods, Grid-Based Methods, Evaluation of clustering. **TB1: Ch.8.1 to 8.5**

Course Outcomes: At the end of the course the student will be able to:22AIM561.1Utilize the principles of mining and analytical processing22AIM561.2Explain appropriate analytical techniques for data analysis22AIM561.3Apply OLAP and analytical modeling22AIM561.4Examine supervised methodologies with multi-dimensional datasets22AIM561.5Examine unsupervised methodologies and parameter tuning22AIM561.6Analyze mining and analytical techniques for real time applications.

Sl.	Title of the Book	Name of the	Name of the	Edition and	
No.	The of the book	Author/s	Publisher	Year	
Text	books				
1	Data Mining Concepts	Jiawei Han, Jian Pei	Floovier	4 th Edition, 2022	
1	and Techniques	and Hanghang Tong	Elsevier		
Refer	ence Books				
1	Introduction to Data	Pang-Ning Tan, Miabaal Stainbaab	Deerson	2 nd Edition 2021	
1	Mining	Vipin Kumar	rearson	2 ⁻² Edition, 2021	
2	Data Warehousing	Alex Berson and	Tata McGraw – Hill		
2.	Data Mining & OLAP	Stephen J. Smith	Edition	10 th Reprint, 2007	

- <u>https://onlinecourses.swayam2.ac.in/cec19_cs01/preview</u>
- https://www.youtube.com/watch?v=m-aKj5ovDfg
- <u>https://nptel.ac.in/courses/106105174</u>
- https://online.stat.psu.edu/stat555/node/11/

Course Outcome		Program Outcomes (POs)												
s(COs)														
										0	1	5	01	02
	P01	P02	P03	P04	P05	PO6	P07	P08	60d	P01	PO1	P01	PSC	PSC
	2								2	2			2	
22AIM561.1	2								2	2			2	
22AIM561.2		3			3				1	2				
22AIM561.3	3								2	2				
22AIM561.4		2	2		2				2					
22AIM561.5			2			2				3			2	1
22AIM561.6						3						3	3	1

Course Articulation Matrix

Full Stack Development							
Course Code	22AIM562	CIE Marks	50				
Course Type	Theory	SEE Marks	50				
(Theory/Practical/Integrated)	Theory	Total Marks	100				
Teaching Hours/Week (L:T:P)	3:0:0	SEE	3 Hours				
Total Hours	40 Hours	Credits	03				
Course Learning Objectives: The objective of the course is to							
Illustrate the Semantic Structure of HTML and CSS							
• Learn to design Client-Side programs using JavaScript							

- Understand the basics of React and create components and lifecycle
- Build applications using React JSX and Node.js
- Design databases using MongoDB

Module-1 HTML and CSS (8 hours)

Introduction to HTML: What is HTML and Where did it come from? HTML Syntax, Semantic Markup, Structure of HTML Documents, Quick Tour of HTML Elements, HTML5 Semantic Structure Elements. **Introduction to CSS:** What is CSS, CSS Syntax, Location of Styles, Selectors, The Cascade: How Styles Interact, The Box Model, CSS Text Styling. **TB1: Ch 2, 3**

Module-2 JavaScript (8 hours)

JavaScript: Client-Side Scripting: What is JavaScript and What can it do? JavaScript Design Principles, Where does JavaScript Go?, Syntax, JavaScript Objects, The Document Object Model (DOM), JavaScript Events, Forms.

TB1: Ch 6 TB2: Ch 1

Module-3 React (8 hours)

Hello World: Hello React World, What Just Happened? React.createElement(), JSX, Setup Babel **The Life of a Component:** A Custom Function Component, A Custom Class Component, Properties, State, A text area Component, Make It Stateful, A Note on DOM Events, Props Versus State, Props in Initial State, Accessing the Component from the Outside, Lifecycle Methods, Lifecycle Example: Log It All, JSX: A Couple Tools, Whitespace in JSX, Comments in JSX, HTML Entities, Spread Attributes, Returning Multiple Nodes in JSX.

TB2: Ch 2, 5

Module-4 Node.js (8 hours)

Welcome to Node.js: Built on JavaScript, Asynchronous and evented, DIRTy applications, DIRTy by default. Building a Multiroom Chat Application: Application overview, Application requirements and initial setup, Serving the application's HTML, CSS, and client-side JavaScript, Handling chat- related messaging using Socket.IO, Using client-side JavaScript for the application's user interface.

TB3: Ch 1, 2

Module-5 MongoDB and Databases (8 hours)

MongoDB Basics: Documents, Collections, Databases, Starting MongoDB, Introduction to the MongoDB Shell, Data Types, Using the MongoDB Shell. Creating, Updating, and **Deleting Documents**: Inserting Documents, Removing Documents, Updating Documents. **Querying**: Introduction to find, Query Criteria, Type-Specific Queries, \$where Queries, Cursors. **TB4: Ch 2, 3, 4**

Course Outcomes: At the end of the course the student will be able to:						
22AIM562.1	Apply HTML and CSS syntax and semantics to build web pages.					
22AIM562.2	Write Client-Side Scripts using JavaScript.					

22AIM562.3	Apply the concepts of React to create Components and design applications using
	the Lifecycle method.
22AIM562.4	Build applications using React JSX.
22AIM562.5	Develop applications using Node.js.
22AIM562.6	Construct Databases using MongoDB.

Sl.	Title of the Book	Name of the	Name of the	Edition and
No.	The of the book	Author/s	Publisher	Year
Text	books			
1	Fundamentals of Web Development	Randy Connolly, Ricardo Hoar	Pearson EducationIndia	1 st Edition, 2023
2	React: Up & Running: Building Web Applications	Stoyan Stefanov	O'Reilly Media,Inc.	2 nd Edition, 2022
3	Node.js in Action	Mike Cantelon, Marc Harter, T.J. Holowaychuk, and Nathan Rajlich	Manning Publications	1 st Edition, 2014
4	MongoDB: The Definitive Guide	Shannon Bradshaw, Eoin Brazil, Kristina Chodorow	O'Reilly Media,Inc.	3 rd Edition, 2022
Refe	rence Books			
1	Learning PHP, MySQL& JavaScript with jQuery, CSS and HTML5	Robin Nixon	O'Reilly Publications	4 th Edition, 2015
2	Professional JavaScript for Web Developers	Nicholas C Zakas	Wrox/Wiley India	3 rd Edition, 2012
3	Node.js Web Development	David Herron	Packt Publishing	4 th Edition, 2018
4	Fullstack React: The Complete Guide to ReactJS and Friends	Anthony Accomazzo,Ari Lerner, Nate Murray, Clay Allsopp, David Gutman, Tyler McGinnis	Fullstack.io	1 st Edition, 2017

- MVT architecture with Django: https://freevideolectures.com/course/3700/django-tutorials
- <u>HTML Tutorial for Beginners | Complete HTML with Notes & Code (youtube.com)</u>
- JavaScript Tutorial for Beginners: Learn JavaScript in 1 Hour (youtube.com)
- Using Python in Django: <u>https://www.youtube.com/watch?v=2BqoLiMT3Ao</u>
- <u>React Tutorial for Beginners (youtube.com)</u>
- Model Forms with Django: <u>https://www.youtube.com/watch?v=gMM1rtTwKxE</u>
- Real time Interactions in Django: https://www.youtube.com/watch?v=3gHmfoeZ45k
- AJAX with Django for beginners: <u>https://www.youtube.com/watch?v=3VaKNyjlxAU</u>

Course Articulation Matrix

Course	Program Outcomes (POs)													
(COs)	P01	P02	£03	P04	504	90d	707	80d	60d	P010	P011	P012	PSO1	PSO2
22AIM562.1			2		2				2	2			1	
22AIM562.2					2								1	
22AIM562.3					2				2					
22AIM562.4					2									
22AIM562.5	2				2				3					
22AIM562.6			2		2				3	3			2	

1: Low 2: Medium 3: High

Cryptography and Cyber Security						
Course Code	22AIM563	CIE Marks	50			
Course Type	Theory	SEE Marks	50			
(Theory/Practical/Integrated)	Theory	Total Marks	100			
Teaching Hours/Week (L:T:P)	3:0:0	SEE	3 Hours			
Total Hours	40 Hours	Credits	03			

- Learn classical encryption techniques for practical application.
- Understand the principles and workings of block ciphers along with their practical applications.
- Acquire knowledge of public-key cryptography, and other public-key cryptosystems.
- Explore various aspects of cybercrime, including its definition, origins, classifications, legal perspectives, and preventive measures.

Module-1 Classical Encryption Techniques (8 hours)

Information and Network Security Concepts: Cybersecurity, Information Security and Network Security, OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, Cryptography, Network Security, Trust and Trustworthiness, Standards.

Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Technique.

Block Ciphers and the Data Encryption Standard: Traditional Block Cipher Structure, The Data Encryption Standard, A DES Example, The Strength of DES, Block Cipher Design Principles **TB1: Ch 1, 3, 4**

Module-2 Block Cipher Operation (8 hours)

Block Cipher Operation: Multiple Encryption and Triple DES, Electronic Codebook, Cipher Block Chaining Mode, Cipher Feedback Mode, Output Feedback Mode, Counter Mode, XTS-AES Mode for Block-Oriented Storage Devices, Format-Preserving Encryption.

Public-Key Cryptography and RSA: Principles of Public-Key Cryptosystems, The RSA Algorithm. TB1: Ch 7, 9

Module-3 Introduction to Cybersecurity (8 hours)

Introduction: Why Cybersecurity? Information Security and Cybersecurity, How Do Computers Work Together?, Cyberattacks Today, Security Targets, **Technique and Human Beings:** Psychological Attacks, Phishing, Humans vs. Machines, Can Psychological Attacks Be Prevented?.**Risk :** What Is Risk?, Threats in IT Systems, Countermeasures, Risk Management, Systematic Security Analysis, Risk Management as a PDCA Process. **TB2: Ch 1, 2, 3**

Module-4 Cyber Crime (8 hours)

Introduction to Cybercrime: Introduction, Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Classifications of Cybercrimes, Cybercrime: The Legal Perspective, Cybercrimes: An Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes, Cybercrime Era.

Cyber offences: How criminals plan them: Introduction, how criminals plan the attacks, Social Engineering, Cyberstalking, Cybercafé and Cybercrimes, Botnets, Attack Vector, Cloud Computing **TB3: Ch 1, 2**

Module-5 Tools used in Cyber Crime and Forensics (8 hours)

Tools and Methods used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks.

Understanding Computer Forensics: Introduction, Historical Background, Digital Forensics Science, The need for Computer Forensics, Cyberforensics and Digital Evidence, Forensics Analysis of E-Mail, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Computer Forensics Investigation, Setting up a Computer Forensic Lab, Computer Forensic and

Steganography, Relevance of OSI 7 Layer Model to Computer Forensics, Forensics and Social Networking Sites, Computer Forensics from Compliance Perspective, Challenges in Computer Forensics, Special Tools and Techniques, Forensics auditing, Antiforensics. **TB3: Ch 4, 7**

Course Outcom	es: At the end of the course the student will be able to:
22AIM563.1	Identify and describe classical encryption techniques, including symmetric ciphers, substitution, and transposition methods.
22AIM563.2	Describe the operation of block cipher modes and the principles behind public- keycryptosystems.
22AIM563.3	Apply fundamental cybersecurity concepts to assess and manage risks in ITsystems.
22AIM563.4	Analyze network security protocols and intrusion detection systems to protectagainst network threats.
22AIM563.5	Evaluate software vulnerabilities and implement appropriate security measures.
22AIM563.6	Design security plan for a system that uses different cryptography and cybersecurity principles.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year	
Text	books			1	
1	Cryptography and Network Security - Principles and Practice	Dr.William Stallings	Pearson Education	7 th Edition, 2017	
2	Introduction to Cybersecurity	Robin Sharp	Springer	1 st Edition, 2023	
3	Cyber Security	Nina Godbole , Sunit Belapure	Wiley	2 nd Edition, 2017	
Refe	rence Books				
1	Introduction to Cryptography with Coding Theory	Wade Trappe and Lawrence C. Washington	Pearson	2 nd Edition, 2005	
2	Cybersecurity: A Practical Guide to the Law of Cyber Risk	Jeffrey R. Kosseff	Wiley	1 st Edition, 2020	
3	Network Security Essentials: Applications and Standards	William Stallings	Pearson	7 th Edition, 2017	
4	Cryptography Engineering: Design Principles and Practical Applications	NielsFerguson,BruceSchneier, andTadayoshiKohno	Wiley	1 st Edition, 2010	

Web links and Video Lectures (e-Resources):

- <u>https://www.coursera.org/learn/classical-cryptosystems</u>
- <u>https://toc.seas.harvard.edu/links/cs-127-cryptography</u>
- <u>https://pll.harvard.edu/subject/cybersecurity</u>
- <u>https://www.coursera.org/learn/cybercrime</u>
- https://learning.edx.org/course/course-v1:RITx+CYBER502x+2T2017/home

Course Articulation Matrix

Course Outcomes		Program Outcomes (POs)												
(COs)	P01	P02	P03	P04	50d	90d	20d	P08	60d	P010	P011	P012	PSO1	PSO2
22AIM563.1	2	2						1	1	1	1			
22AIM563.2	2	2						1	1	1	1			
22AIM563.3	3	3												
22AIM563.4	3	3												
22AIM563.5					2	2								
22AIM563.6					1	1		1		1			1	

Business Intelligence							
Course Code	22AIM564	CIE Marks	50				
Course Type	Theory	SEE Marks	50				
(Theory/Practical/Integrated)	Theory	Total Marks	100				
Teaching Hours/Week (L:T:P)	3:0:0	SEE	3 Hours				
Total Hours	40 Hours	Credits	03				

- Understand the Business Intelligence, Analytics and Decision Support system.
- Understand the decision making process and identify the technologies for decision support systems
- Understand data warehousing, business reporting, visual analytics and business performance management operations.
- Understand the importance of data mining for the decision making process.
- Understand the importance of modelling and automated decision systems in various applications

Module-1 Introduction to Business Intelligence, Analytics and Decision Support (8 hours)

Overview of Business Intelligence, Analytics and Decision Support: Changing Business Environments and Computerized Decision Support, Managerial decision making, Information Systems Support for Decision Making, An Early Framework for Computerized Decision Support, The Concept of Decision Support Systems(DSS), A Framework for Business Intelligence, Business Analytics Overview, Brief Introduction to Big Data Analytics.

Case Study: Business Intelligence, Business Analytics and Big Data. **TB1**

Module-2 Decision Making and Decision Support Systems (8 hours)

Foundations and Technologies for Decision Making: Decision Making, Models, Phases of the Decision-Making Process, The Intelligence Phase, The Design Phase, The Choice Phase, The Implementation Phase, How Decisions Are Supported, Decision Support Systems Capabilities, Decision Support Systems Classification, Decision Support Systems Components.

Case Study: Decision making and Decision Support components. **TB1**

Module-3 Descriptive Analytics: Data Warehousing and Business Reporting (8 hours)

Data warehousing: Data Warehousing Definitions and Concepts, Data Warehousing Process Overview, Data Warehousing Architectures, Data Integration and the Extraction, Transformation, and Load (ETL) Processes. Data warehouse Development, Data Warehousing Implementation Issues.

Business Reporting, Visual Analytics, Business Performance Management: Business Reporting Definitions and Concepts, Data and Information Visualization, Different Types of Charts and Graphs, The Emergence of Data Visualization and Visual Analytics, Performance Dashboards, Business Performance Management, Performance Measurement, Balanced Scorecards, Six Sigma as a Performance Measurement System

Case Study: Data Warehousing, ETL, Business Reporting **TB1**

Module-4 Predictive Analytics: Data Mining (8 hours)

Data Mining: Data Mining Concepts and Applications, Data Mining Applications, Data Mining Process, Data Mining Methods, Data Mining Software Tools, Data Mining Privacy Issues, Myths, and Blunders.

Case Study: Data mining and Prediction applications TB1

Module-5 Prescriptive Analytics: Model based Decisions Support and Expert Systems (8 hours)

Model based Decision Making: Decision Support Systems Modeling, Structure off Mathematical Models for Decision Support, Certainty, Uncertainty, and Risk, Management Support Systems, Multiple Goals, Sensitivity Analysis, What-If Analysis, and Goal Seeking.

Expert Systems: Basic Concepts of Expert Systems, Applications of Expert Systems, Structure of Expert Systems, Knowledge Engineering, Problem Areas Suitable for Expert Systems, Development of Expert Systems, Benefits, Limitations, and Critical Success Factors of Expert Systems. Case Study: Application of expert systems. **TB1**

Course Outcom	es: At the end of the course the student will be able to:
22AIM564.1	Apply the types of data to the Decision Support systems and Business Intelligence framework.
22AIM564.2	Apply the decision making process and DSS concepts in the business applications supporting problem resolution.
22AIM564.3	Analyze the importance of data warehousing and business reporting tools toperform descriptive analytics for business issues in the organizations.
22AIM564.4	Analyze the relevance of data mining based predictions in decision making toperform prescriptive analytics for business decisions in the organizations.
22AIM564.5	Analyze the value of model based and expert systems in the decision making process and also discuss areas suitable for application of expert system.
22AIM564.6	Analyze the influence of technologies & business intelligence in overcoming theissues in various business application cases.

Sl.	Title of the Book	Name of the	Name of the	Edition and	
No.	The of the book	Author/s	Publisher	Year	
Text	books				
1	Business Intelligence and Analytics: Systems for decision support	Ramesh Sharda, Dursun Delden, Efraim Turban	Pearson Publishers	10 th Edition, 2015	
Refe	rence Books				
1	Business Intelligence The Savvy Manager's Guide	David Loshin	Elsevier Publishers	2 nd Edition, 2013	
2	Fundamentals of Business Analytics	R N Prasad, Seema Acharya	Wiley Publishers	2 nd Edition, 2016	
3	Data MiningTechniques. ForMarketing, Sales and Customer Relationship Management	Berry M. &Linoff G	Wiley PublishingInc	2 nd Edition, 2004	
4	Data Science for Business	Foster Provost and Tom Fawcett	O'Reilly Media,Inc	1 st Edition, 2013	

- https://www.youtube.com/watch?v=dn97ux9exbY
- https://www.youtube.com/watch?v=N8F7eOqgH8Q
- https://www.youtube.com/watch?v=zbcCdoHeS4w
- https://www.youtube.com/watch?v=KSJqdMqLQA4
- https://www.youtube.com/watch?v=jkCCnwvO_fg
- https://www.youtube.com/watch?v=Yb2KF-sAJh4
- https://www.netsuite.com/portal/resource/articles/business-strategy/businessintelligence- examples.shtml

Course	Articu	lation	Matrix
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Course	Program Outcomes (POs)													
(COs)	P01	P02	PO3	P04	P05	P06	P07	PO8	P09	P010	P011	P012	PSO1	PSO2
22AIM564.1	1								1	2			1	
22AIM564.2	2								1	2			1	
22AIM564.3	2		2		2				1	2			1	
22AIM564.4	2		2						1	2			2	
22AIM564.5	2		2						1	2			2	1
22AIM564.6	2				2				1	2			2	1

1: Low 2: Medium 3: High

Research Methodology and Intellectual Property Rights					
Course Code	22RMI57	CIE Marks	50		
Course Type	Theory	SEE Marks	50		
(Theory/Practical/Integrated)	Theory	Total Marks	100		
Teaching Hours/Week (L:T:P)	(2:0:0)	SEE	3 Hours		
Total Hours	25 hours	Credits	02		

Course Learning Objectives:

- 1. To understand the basic concepts related to research
- 2. To learn the concept of literature survey, review and technical writing
- 3. To discuss the basics of intellectual property
- 4. To explain the patents, copyrights, trademarks, industrial designs and geographical indications

Module-1 Research Methodology and Literature Survey (5 hours)

Research Methodology: Meaning, Objectives, Types of research, Method versus methodology, Research process, Criteria of good research.

Literature Survey, Literature Review: Introduction, process, databases and management tools. Identifying gap areas from literature review. Plagiarism: Introduction, tools for detection, avoiding plagiarism. Illustrations.

Textbook 1: Chapter 1, Textbook 2: Ch 7-9, 14-17.

Module-2 Technical Writing and Presentations (5 hours)

Research Paper Writing: Importance, steps of writing research papers, Contents of a research article, Illustrations.

Thesis Writing: Synopsis, Introduction, Literature review, Aim and Objectives, Methodology, Time frame, Results and discussions, Conclusions. Illustrations.

Research Proposal Writing: Preliminary requirements for proposal writing, Standard heads in research proposal. Illustrations.

Textbook 2: Chapter 20-22, 26-28, 35.

Module-3 Introduction to IPR and Patents (5 hours)

Introduction to Intellectual Property: Types of IP, Role of IP in the economic and cultural development of the society, IP governance, IP as a global indicator of innovation, National IPR Policy in India. Textbook 3: Chapter 1,

Patents: Conditions for patent, Non-patentable matters, Inventions Eligible for Patenting, Salient features of the Indian Patent 1970, Process of patenting, Types of patent applications, Patent infringements. Case examples. Textbook 3: Chapter 2: 2.1.

Module-4 Copyright and Trademarks (5 hours)

Copyright: Classes of copyrights, Salient features of the Indian Copyright Act 1957, Criteria for copyright, Copyrights of the author, Copyright Infringements, Non-Copyright Work, Process of copyright registration. Copyright cases.

Trademark: Eligibility Criteria, Classification, Trade Mark Rules 2017, Advantages of registration, Types of trademark registered in India, Process for Trademarks Registration, Case examples.

Textbook 3: Chapter 2: 2.2 and 2.3.

Module-5 Industrial Designs and Geographical Indications (5 hours)

Industrial Designs: Introduction, Eligibility criteria, Famous industrial designs, Features of Design Act 2000, Non-Protectable industrial designs in India, Procedure for Registration of Industrial Designs, Case examples.

Geographical Indications (GIs): Introduction, Rights granted to holders, Popular GIs registered in India, salient features of Geographical Indications of Goods (Registration & Protection) Act, 1999, Non-Registerable GI, Procedure for GI Registration, Case examples. Textbook 3: Chapter 2: 2.4 and 2.5.

Course Outco	Course Outcomes: At the end of the course the student will be able :					
22RMI57.1	To conduct literature survey, review and define a research problem.					
22RMI57.2	To follow research ethics and develop the art of writing technical papers and reports.					
22RMI57.3	To discuss the role of Intellectual Property and Patents in India.					
22RMI57.4	To explain the various aspects of Copyright and Trademark in Indian context.					
22RMI57.5	To explain legal aspects of Industrial Designs and Geographical Indications in India.					
22RMI57.6	To discuss the case studies related to the different Intellectual Property.					

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textb	ooks			
1	Research Methodology: Methods and Techniques	C R Kothari and Gaurav Garg	New Age International Publishers	4 th Edition 2019
2	Academic Writing	Ajay Semalty	B S Publications	2021
3	Intellectual Property: A Primer for Academia	Prof. Rupinder Tewari and Ms. Mamta Bhardwaj	Publication Bureau, Panjab University, India	2021
Refer	ence Books			
1	Research Methodology: A Step-by-Step Guide for Beginners	Ranjit Kumar	Sage Publications India Pvt Ld New Delhi	4 th Edition 2014
2	Intellectual Property Rights – Laws and Practice	The Institute of Company Secretaries of India, New Delhi	Delhi Computer Services, New Delhi	2018
Addit <u>httr</u>	ional Resources: Web links/NI os://ipindia.gov.in/ (Official web	PTEL Courses site of Intellectual Property	India)	

https://dpiit.gov.in/policies-rules-and-acts/policies/national-ipr-policy

https://www.icsi.edu/media/webmodules/FINAL_IPR&LP_BOOK_10022020.pdf

https://corpbiz.io/learning/design-infringement-in-india/

https://nptel.ac.in/courses/121106007 (Introduction to Research (Research Methodology)) https://nptel.ac.in/courses/109105112 (Introduction on Intellectual Property to Engineers)

Course Articulation Matrix

Course Program Outcomes (POs)														
Outcomes (COs)	PO1	PO2	PO3	P04	PO5	PO6	PO7	PO8	60d	PO1	PO1	PO1	PSO	PSO
22RMI57.1	-	2	-	-	1	-	-	-	-	-	-	2	-	-
22RMI57.2	-	-	-	-	1	-	-	3	-	2	-	-	-	-
22RMI57.3	-	-	-	-	-	2	-	-	-	2	-	-	-	-
22RMI57.4	-	-	-	-	-	2	-	-	-	2	-	-	-	-
22RMI57.5	-	-	-	-	-	2	-	-	-	2	-	-	-	-
22RMI57.6	-	-	-	-	-	2	-	-	-	2	-	-	-	-

Emerging Technologies: A Primer								
Course Code	22ETP58	CIE Marks	100					
Teaching Hours/Week (L:T:P)	(0:0:2)	SEE Marks	-					
Credits 1 Exam Hours 03								

Course Learning Objectives:

- 1. To develop a strong awareness of the ethical and societal implications associated with emerging technologies.
- 2. To instil practical skills related to AI (Artificial Intelligence), Blockchain, Digital Twins, RPA (Robotic Process Automation), and Cybersecurity.
- 3. To enable experiences of working on a team project, allowing students to apply their knowledge and skills to a real-world problem and present their findings effectively.

Module-1: AI and Web 3.0 (06 Hours)

Introduction to Emerging Technologies: Overview of the course, Importance of staying updated with emerging technologies, Ethical and societal considerations.

Artificial Intelligence (AI): Definition and history of AI, Machine learning and deep learning, Applications of AI in various industries, In-Class Assignment: AI in Everyday Life, Homework Assignment: Building a Simple Chatbot.

Web 3.0: Blockchain and Metaverse - Introduction to Blockchain technology, Metaverse and its potential, In-Class Assignment: Creating a Simple Smart Contract, Homework Assignment: Exploring a Metaverse Platform.

Module-2: Smart Manufacturing and Robotic Process Automation (06 Hours)

Smart Manufacturing and Digital Twins: The concept of Smart Manufacturing, Role of IoT and sensors, Digital Twins and their applications, In-Class Assignment: Explore the designs of Digital Twins, Homework Assignment: Analysing a Smart Manufacturing Case Study.

Robotic Process Automation: Understanding Robotic Process Automation (RPA), Types of robots and their applications, Human-robot collaboration, In-Class Assignment: Automating a Task with RPA, Homework Assignment: Researching Advances in Robotics.

Module-3: Cybersecurity and Quantum Computing (06 Hours)

Cybersecurity: Importance of cybersecurity in the digital age, Threats and vulnerabilities, Security best practices, In-Class Assignment: Ethical Hacking Simulation, Homework Assignment: Creating a Cybersecurity Plan.

Quantum Computing: Introduction to Quantum Mechanics, Quantum bits (qubits) and quantum gates, Quantum supremacy and real-world applications. Homework Assignment: Exploring Quantum Computing Research.

Module-4: Project Work (06 Hours)

Team Formation, Synopsis submission, Mid-Term Progress Review, Final Project Presentation.

Course Outcome	Jourse Outcomes: At the end of the course the student will be able to:						
22ETP58.1	Assess the ethical and societal impacts of emerging technologies, demonstrating critical thinking skills.						
22ETP58.2	Apply AI and Web 3.0 concepts to develop practical solutions and explore real- world applications.						
22ETP58.3	Apply RPA principles and tools to automate common tasks to boost productivity.						
22ETP58.4	Explain common cybersecurity threats and recommend best practices to safeguard digital assets.						
22ETP58.5	Explain the fundamentals of quantum computing and its real-world applications.						
22ETP58.6	Develop a solution using emerging technologies for a real-world problem in teams.						

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Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbo	oks			
1	Artificial Intelligence: A Modern Approach	Stuart Russell, Peter Norvig	Pearson	Fourth Edition, 2020
2	Blockchain Technology	Chandramouli Subramanian, Asha A George, Abhilash K A and Meena Karthikeyan	Universities Press (India) Pvt. Ltd.	First Edition 2020
3	Metaverse and Web 3: A Beginner's Guide: A Beginner's Guide: A Digital Space Powered with Decentralized Technology	Utpal Chakraborty	BPB Publications	First Edition, 2022
4	Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath	Alok Mani Tripathi	Packt Publishing	First Edition 2018
5	Cybersecurity: The Beginner's Guide: A comprehensive guide to getting started in cybersecurity	Dr. Erdal Ozkaya	Packt Publishing Limited	First Edition 2019
6	Quantum Computing: A Gentle Introduction	Eleanor G. Rieffel, Wolfgang H. Polak.	MIT Press	First Edition 2014
Referen	nce Books			
1	SmartManufacturingTechnologies for Industry 4.0:Integration, Benefits, andOperational Activities	Edited By: Jayakrishna Kandasamy, Kamalakanta Muduli, V. P. Kommula, Purushottam L. Meena	CRC Press	First Edition 2022
2	The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems	Tom Taulli	Apress Berkeley, CA	2020
3	The Cyber Security Handbook: Prepare for, respond to and recover from cyber-attacks with the IT Governance Cyber Resilience Framework (CRF)	Alan Calder	IT Governance Publishing	First Edition 2020
Web lin	nks/Video Lectures:	1 0		
1	https://ajethics.princeton.edu/case	•• -studies/case-study-pdfs/		
2.	https://research.aimultiple.com/ai-	ethics/		
3.	https://news.harvard.edu/gazette/s	tory/2020/10/ethical-concerns	<u>s-mount-as-ai</u> -tal	kes-bigger-
	decision-making-role/			
4.	https://www.sciencedirect.com/sci	ience/article/pii/S0268401223	8000816	
5.	https://www.youtube.com/watch?	v=G2fqAlgmoPo		
6.	https://www.youtube.com/watch?	v=zizonToFXDs		
Web 3.	0: Blockchain and Metaverse			
1.	What is Ethereum? ethereum.org			
2	Navigating Remix Demix Eth	eroum IDE 1 documentation	(remix_ide readt	hedocs ic)

- 3. <u>Solidity Solidity 0.6.8 documentation (soliditylang.org)</u>
- 4. <u>https://www.youtube.com/watch?v=nalMdCI_pv8&t=765s</u>
- 5. <u>The Decentralized Autonomous Organization and Governance Issues by Usman W. Chohan ::</u> <u>SSRN</u>
- 6. <u>Ethereum Smart Contract Best Practices (consensys.github.io)</u>
- 7. https://hackernoon.com/hack-solidity-reentrancy-attack

Smart Manufacturing and Digital Twins:

- 1. <u>https://www.youtube.com/watch?v=nwFed03fS_s</u>
- 2. <u>https://www.youtube.com/watch?v=ScmK-bKJ4MI</u>

RPA and Robotics:

- 1. <u>https://www.youtube.com/watch?v=9URSbTOE4YI</u>
- 2. https://www.youtube.com/watch?v=UEbw7dIOg0g
- 3. <u>https://www.uipath.com/resources/automation-case-studies</u>
- 4. https://www.ibm.com/products/robotic-process-automation/case-studies

Cybersecurity:

- 1. <u>https://www.getastra.com/blog/security-audit/what-is-vapt/</u>
- 2. <u>https://owasp.org/www-project-top-ten/</u>
- 3. https://owasp.org/www-project-mutillidae-ii/
- 4. https://www.youtube.com/watch?v=JAtwZoW76-I
- 5. Threat modelling (STRIDE framework): <u>https://learn.microsoft.com/en-us/azure/security/develop/threat-modeling-tool-threats</u>
- 6. Cyber Kill Chain:<u>https://www.lockheedmartin.com/en-us/capabilities/cyber/cyber-kill-chain.html</u>

Quantum Computing:

- 1. <u>https://www.youtube.com/watch?v=e3fz3dqhN44</u>
- 2. https://quantumai.google/

Course Articulation Matrix

Course					Progr	am Out	comes	(POs)				
Outcomes (COs)	POI	P02	PO3	P04	PO5	P06	PO7	PO8	P09	P010	P011	P012
22ETP58.1	-	-	-	-		3	-	2	-		-	-
22ETP58.2	-	2	-	-	3	-	-	-		-	-	1
22ETP58.3	-	-	-	3	2	-	-	-		-	-	-
22ETP58.4	-	-	-	-	3	-		-	-	-	-	1
22ETP58.5	2	-	-	-	3	-	-	-	-	-	-	-
22ETP58.6	-	-	2	-	3	-		-	2	-	-	1

VI Semester

Digital Image Processing									
Course Code	22AIM61	CIE Marks	50						
Course Type	Into anota d	SEE Marks	50						
(Theory/Practical/Integrated)	Integrated	Total Marks	100						
Teaching Hours/Week (L:T:P)	3:0:2	SEE	3 Hours						
Total Hours	40 hours Theory + 10 Lab slots	Credits	04						

- Understand the fundamentals of digital image processing.
- Know image transformation techniques used in digital image processing.
- Understand the image enhancement techniques used in digital image processing.
- Learn the image restoration techniques, Morphological Operations and Segmentation used in digital image processing.
- Apply the digital image processing techniques in real-time captured images.

Module-1 Digital Image Fundamentals (8 hours)

Digital Image Fundamentals: What is Digital Image Processing? Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships between Pixels, Linear and Nonlinear Operations.

TB1: Ch 1, Ch 2 - 2.1 to 2.5, 2.6.2

Module-2 Spatial and Frequency Domain (8 hours)

Spatial Domain: Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering,-Smoothing Spatial Filters, Sharpening Spatial Filters.

Frequency Domain: Preliminary Concepts, The Discrete Fourier Transform (DFT) of Two Variables, Properties of the 2-D DFT, Filtering in the Frequency Domain, Image Smoothing and Image Sharpening Using Frequency Domain Filters, and Selective Filtering.

TB1: Ch 3 - 3.2 to 3.6 , Ch 4 - 4.2, 4.5 to 4.10

Module-3 Image Restoration (8 hours)

Restoration: Noise models, Restoration in the Presence of Noise Only using Spatial Filtering and Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, and Constrained Least Squares Filtering.

TB1: Ch 5 - 5.2 to 5.9

Module-4 Processing Images (8 hours)

Color Image Processing: Color Fundamentals, Color Models, and Pseudo-color Image Processing **Wavelets:** Background, Multiresolution Expansions. **Morphological Image Processing** Preliminaries, Erosion and Dilation, Opening and Closing, The Hit-or-Miss Transforms, and Som Basic Morphological Algorithms.

TB1: Ch 6 - 6.1 to 6.3, Ch 7 – 7.1,7.2, Ch 9 - 9.1 to 9.5

Module-5 Image Segmentation (8 hours)

Segmentation: Introduction, classification of image segmentation algorithms, Detection of Discontinuities, Edge Detection, Hough Transforms and Shape Detection, Corner Detection, and Principles of Thresholding. Representation & Description: Representation, Boundary descriptors. TB2: Ch 9 - 9.1 to 9.7 TB 1: Ch 11 - 11.1, 11.2

PRACTICAL MODULE

- 1. Write a Program to read a color digital image and perform the following:
 - (i) Split and display its RGB channels. Apply zeros to other channels, display RGB channels again, and observe the differences.
 - (ii) Convert it to grayscale and binary image. Display all the images one by one along with its histogram.
- 2. Write a Program to read a digital image and perform the following:
 - (i) Split and display image into four quadrants Topleft, Top Right, Bottom Left and Bottom Right.
 - (ii) Demonstrate rotation, scaling, and translation of an image.
- 3. Demonstrate different image transformation like Negative, Logarithmic and Power-Law (gamma) techniques.
- 4. Demonstrate histogram equalization, contrast stretching and bit-plane slicing for a low contrast 2D image.
- 5. Demonstrate Smoothing, Sharpening and Noise removal for a poor quality image.
- 6. Write a Program to read an image, first apply erosion to the image and then subtract the result from the original. Apply dilation to the image and then subtract it with the original. Observe and demonstrate the differences in each.
- 7. Write a Program to read an image. Extract and display low-level features, textures features and color features.
- 8. Demonstrate Edge detection and Region-Based segmentation in an image.

OPEN ENDED EXPERIMENTS

- 1. Classification of Image Category
- 2. Detection of Skin Disease or Plant Disease

Course Outcomes: At the end of the course the student will be able to:								
22AIM61.1	escribe the basics of image processing concepts through mathematical interpretation.							
22AIM61.2	Apply image processing techniques in both the spatial and frequency (Fourier) domains.							
22AIM61 .3	Experiment with image restoration process and its respective filters							
22AIM61.4	Analyze different image enhancement techniques in the form of image segmentation.							
22AIM61.5	Evaluate the Methodologies for Edge and Shape Detection.							
22AIM61.6	Develop independent study for Image Enhancement techniques.							

Sl.	Title of the Book	Name of the	Name of the	Edition and
No.	The of the book	Author/s	Publisher	Year
Text	tbooks			
1	Digital Image Processing	Rafael C. Gonzalez,	Prentice Hall	4 th Edition, 2018
		Richard E. Woods		
2	Digital Image Processing	S. Sridhar	Oxford University	2 nd Edition, 2016
			Press	
Refe	rence Books			
1	Fundamentals of Digital Image Processing	A. K. Jain	Pearson	1 st Edition, 2015

2	Digital Image Processing Using MATLAB	Ralph Gonzalez, Richard Woods, Steven Eddins	McGraw Hill Education	2 nd Edition, 2017
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- https://onlinecourses.nptel.ac.in/noc19_ee55/preview
- https://www.mygreatlearning.com/academy/learn-for-free/courses/digital-image-processing
- https://www.coursera.org/learn/digital
- https://free.aicte-india.org/Digital-Image-Processing.php
- https://www.youtube.com/watch?v=1I6kfkY4GyQ
- https://www.youtube.com/watch?v=CVV0TvNK6pk

Course		Program Outcomes (POs)												
(COs)	P01	P02	P03	P04	P05	P06	P07	PO8	909	P010	P011	P012	PSO1	PSO2
22AIM61.1			2		1					1				
22AIM61.2				2	1					2		2		
22AIM61.3					2		2						2	
22AIM61.4				2	2							2		
22AIM61.5					2		1					1	2	
22AIM61.6			2		2									

Course Articulation Matrix

Advanced AI and ML									
Course Code	22AIM62	CIE Marks	50						
Course Type	Interneted	SEE Marks	50						
(Theory/Practical/Integrated)	Integrated	Total Marks	50 50 100 3 Hours 04						
Teaching Hours/Week (L:T:P)	3:0:2	SEE	3 Hours						
Total Hours	40 hours Theory + 10 Lab slots	Credits	04						
Course Learning Objectives: T	ne objective of the course is to								
• Articulate fundamentals of]	Intelligent Agents.								
• Demonstrate the reasoning on Uncertain Knowledge.									
• Examine explanation-based	learning in solving AI problems.								

- Illustrate the use of KNN
- Explore the Text feature Engineering concepts with Applications

Module-1 Uncertain knowledge and Reasoning (8 hours)

Quantifying Uncertainty: Acting under Uncertainty, Basic Probability Notation, Inference Using Full Joint Distributions, Independence, Bayes' Rule and Its Use The WumpusWorld Revisited.**TB1: Ch 13**

Module-2 Probabilistic Reasoning (8 hours)

Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Efficient Representation of Conditional Distributions Exact Inference in Bayesian Networks, Approximate Inference in Bayesian Networks. **TB1: Ch 14.**

Module-3 Neural Network and Genetic Algorithms (8 hours)

Neural networks Representation: Brief history and Evolution of Neural network, Biological neuron, Basics of ANN, Activation function, MP model. **TB3: Ch 6**

Neural Network and genetic algorithms: Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evolution and Learning. **TB2: Ch 4.3 to 4.6 ,Ch 9.2, 9.4, 9.5**

Module-4 Recommendation and Text Analytics (8 hours)

Recommender System: Datasets, Association rules, Collaborative filtering, User-based similarity, item-based similarity, using surprise library, Matrix factorization.

Text Analytics: Overview, Sentiment Classification, Naïve Bayes model for sentiment classification, using TF-IDF vectorizer, Challenges of text analytics. **TB4:** Ch 9, Ch 10

Module-5 Information Retrieval and Extraction (8 hours)

Language Models, Information Retrieval: IR scoring functions, IR system evaluation, IR refinements, The PageRank algorithm, The HITS algorithm, Question answering. Information Extraction: Probabilistic models for information extraction, Conditional random fields for information extraction. TB1: Ch 22.1, 22.3, 22.4

PRACTICAL MODULE

- 1. Write a program to demonstrate the working of following algorithms:
 - (i) k-Nearest Neighbour algorithm
 - (ii) SVC classifier for a suitable data set
- 2. Develop a program to apply the K-means algorithm to cluster a set of data stored in .CSV file. Use the same data set for clustering using the EM algorithm. Compare the results of thesetwo algorithms and comment on the quality of clustering.
- 3. Implement Bayesian Network considering Medical Data.
- 4. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
- 5. Demonstrate Genetic algorithm by taking suitable data for any simple application.
- 6. Implement AO* Search algorithm.
- 7. Implement a Matrix factorization on a suitable dataset.
- 8. Design Conditional Random Fields (CRFs) for POS tagging.

OPEN ENDED EXPERIMENTS

- 1. Implement Page Rank algorithm for any simple application.
- 2. Implement HITS algorithm to find the authority and hub scores

Course Outcomes: At the end of the course the student will be able to:						
22AIM62.1	Explain the reasoning on Uncertain Knowledge.					
22AIM62.2	Discuss the representation of Conditional Distributions.					
22AIM62.3	Apply explanation-based learning to solve AI problems.					
22AIM62.4	Investigate ML algorithms effectively to solve real world problems.					
22AIM62.5	Examine Instant based techniques and derive effectively learning rules to real world problems.					
22AIM62.6	Analyze AI and ML techniques in a range of real-world applications.					

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Text	books			
1	Artificial Intelligence, A Modern Approach	Stuart J. Russell, Peter Norvig	Pearson	3 rd Edition, 2015
2	Machine Learning	Tom M. Mitchell	McGraw-Hill Education	1 st Edition, 2017
3	Machine Learning	Anuradha Srinivasaraghavan,Vincy Joeph	Wiley	1 st Edition, 2019
4	Machine Learning using Python	Manaranjan Pradhan,U Dinesh Kumar	Wiley	1 st Edition, 2019
Refei	rence Books			
1	An Introduction to Multi Agent Systems	Michael Wooldridge	John Wiley &Sons Inc	2 nd Edition, 2009

Web links and Video Lectures (e-Resources):

- <u>https://nptel.ac.in/courses/106/102/106102220/</u>
- https://www.youtube.com/playlist?list=PL1xHD4vteKYVpaIiy295pg6_SY5qznc77
- https://nptel.ac.in/courses/106/106/106106139/

Course Articulation Matrix

Course Outcomes (COs)		Program Outcomes (POs)												
	P01	P02	P03	P04	PO5	P06	P07	PO8	P09	P010	P011	P012	PSO1	PSO2
22AIM62.1	2								2	2			1	
22AIM62.2		2			2				2				2	
22AIM62.3	3								2	2				
22AIM62.4		2	2		2				1				2	
22AIM62.5			2			2				2			2	2
22AIM62.6						3						3	2	1

Natural Language Processing									
Course Code	22AIM63	CIE Marks	50						
Course Type	Theory	SEE Marks	50						
(Theory/Practical/Integrated)	Theory	Total Marks	100						
Teaching Hours/Week (L:T:P)	3:0:0	SEE	3 Hours						
Total Hours	40 Hours	Credits	03						

- Introduce the fundamental concepts and techniques of natural language processing.
- Gain an in-depth understanding of the computational properties of natural languages
- Understand the commonly used algorithms for processing linguistic information.
- Examine NLP models and algorithms using both the traditional symbolic and the more recent statistical approaches.
- Explain the applications of NLP and challenges in processing natural language texts.

Module-1 Introduction and Language Modelling (8 hours)

Introduction: What is NLP, Origins of NLP, Language and Knowledge, Challenges, Language & Grammar, Processing Indian Languages, NLP applications.

Language Modeling: Introduction, Grammar based Language Models-Generative Grammars, Statistical Language Model- N-gram models

TB1: Ch 1, TB2: Ch 1, 2

Module-2 Word Level Analysis (8 hours)

Word Level Analysis: Introduction, Regular Expressions, Finite State Automata, Morphological Parsing, Spelling Error Detection and Correction, Words and Word Classes, Part of-Speech tagging TB2: Ch 3

Module-3 Syntactic Analysis (8 hours)

Syntactic Analysis: Context-Free Grammar, Constituency-Phrase level, Sentence level, Parsing Top-down Parsing, Bottom-up Parsing, A Basic Top-Down Parser, Ambiguity in Parsing, The CYK Parser, Probabilistic Parsing, Indian Languages.

TB2: Ch 4

Module-4 Semantic Analysis and Discourse (8 hours)

Semantic Analysis: The representation of meaning, Syntax driven semantic analysis, Word Senses Relations between senses, WordNet: A Database of Lexical Relations, Word Sense Disambiguation Computational Discourse: Discourse segmentation, Text Coherence Relations, Reference Resolution, Anaphora resolution.

TB1: Ch 19, 20.1, 21 TB2: Ch 5

Module-5 Introduction to Speech Processing (8 hours)

Phonetics-Speech sounds and Phonetic Transcription, Articulatory Phonetics, Phonological categories, Acoustic phonetics and signals. **TB1: Ch 7**

Course Outcomes: At the end of the course the student will be able to:22AIM63.1Discuss importance of NLP and the techniques used for language
modelingin NLP22AIM63.2Discover the tools and techniques for Processing natural language texts at
wordand sentence level.22AIM63.3Analyze natural language texts for syntax.22AIM63.4Examine natural language texts for semantics and pragmatics.22AIM63.5Analyze the important concepts of phonetics and computational phonetics.22AIM63.6Build real time applications to carry out natural language processing.

Sl.	Title of the Book	Name of the	Name of the	Edition
No.	The of the Book	Author/s	Publisher	and Year
Text	books			
1	Speech and Language processing: Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition.	Daniel Jurafsky, James H Martin	Pearson Publications	3 rd Edition, 2023
2	Natural Language Processing and Information Retrieval	U S. Tiwary, Tanveer Siddiqui	Oxford UniversityPress	1 st Edition, 2008
Refer	ence Books			
1	Practical Natural Language Processing: A Comprehensive Guide to Building Real-World NLP Systems	Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta, Harshit Surana	O'Reilly Media,Inc.	1 st Edition, 2020
2	Information Storage and Retrieval systems –Theory and Implementation	Gerald J. Kowalski and Mark. T. Maybury	Kluwer academic Publishers	2 nd Edition, 2006

- <u>https://scikitlearn.org/stable/tutorial/text_analytics/working_with_text_data.html</u>
- https://nptel.ac.in/courses/106101007
- <u>https://onlinecourses.nptel.ac.in/noc19_cs56/preview</u>
- https://www.youtube.com/watch?v=3_oCVemqzFo
- https://www.youtube.com/playlist?list=PLEuhkeqNvDnJ00VSJsv9VuRnIocxGs_DB

		Program Outcomes (POs)												
Course Outcomes (COs)	P01	P02	£03	P04	50d	90d	707	PO8	60d	P010	P011	P012	PSO1	PSO2
22AIM63.1			2											
22AIM63.2				2	2									
22AIM63.3		2	2											
22AIM63.4		2	2											
22AIM63.5		2	2											
22AIM63.6					2								1	

Course Articulation Matrix

1: Low 2: Medium 3: High

Robotic Process Automation									
Course Code	22AIM641	CIE Marks	50						
Course Type	Theory	SEE Marks	50						
(Theory/Practical/Integrated)	Theory	Total Marks	100						
Teaching Hours/Week (L:T:P)	3:0:0	SEE	3 Hours						
Total Hours	40 Hours	Credits	03						

- Understand the basic concepts of RPA.
- Know where RPA can be applied and how it is implemented.
- Learn the different types of variables, Control Flow and data manipulation techniques.
- Understand Image, Text and Data Tables Automation
- Know various types of Exceptions and strategies to handle

Module-1 RPA Foundations and Skills (8 hours)

IRPA Foundations: What is RPA?, Flavors of RPA, History of RPA, The Benefits of RPA, The downsides of RPA, RPA Compared to BPO, BPM and BPA, Consumer Willingness for Automation, The Workforce of the Future. **RPA Skills:** On-Premise Vs. the Cloud, Web Technology, Programming Languages and Low Code, OCR, Databases, APIs, AI, Cognitive Automation, Agile, Scrum, Kanban and Waterfall, DevOps, Flowcharts. **TB1:** Ch 1, Ch 2

Module-2 Robotic Process Automation, Record and Play (8 hours)

Process Methodologies: Lean Six Sigma, How to Implement Six Sigma, Six Sigma Roles and Levels, Lean Six Sigma, Finding the Right Balance, Applying Lean and Six Sigma to RPA Conclusion. **Robotic process automation:** Components of RPA, RPA Platforms, About UiPath, The future of automation. **Record and Play:** Downloading and installing UiPath Studio, Learning UiPath Studio, Task recorder - Step-by-step examples using the recorder.

TB1: Ch 3, TB2: Ch 1, Ch 2

Module-3 Sequence, Flowchart, and Control Flow and Data Manipulation (8 hours)

Sequence, Flowchart, and Control Flow: Sequencing the workflow, Activities, Control flow, various types of loops, and decision making, Step-by-step example using Sequence and Flowchart, Step-by-step example using Sequence and Control flow. **Data Manipulation:** Variables and Scope, Collections, Arguments - Purpose and use, Data table usage with examples, Clipboard management, File operation with step-by-step example, CSV/Excel to data table and vice versa (with example). **TB2: Ch 3, Ch 4**

Module-4 Taking Control of the Controls (8 hours)

Taking Control of the Controls: Finding and attaching windows, Finding the control, Techniques forwaiting for a control, Act on controls - mouse and keyboard activities, Working with UiExplorer, Handling events, Revisit recorder, Screen Scraping, When to use OCR, Types of OCR available, How to use OCR, Avoiding typical failure points. **TB2: Ch 5**

Module-5 Exception Handling, Debugging, and Logging, Future of RPA (8 hours)

Exception Handling, Debugging, and Logging: Exception handling, Common exceptions, ways to handle, Logging and taking screenshots, Debugging techniques, Collecting crash dumps, Error reporting. **Future of RPA:** Consolidation and IPOs, Microsoft, Attended Automation, Vertical-Specific Companies, Hype Factor, SaaS, Chatbots, AI, Privacy and Ethics. **TB2:** Ch 8, Ch 10.

Course Outcomes: At the end of the course the student will be able to:							
22AIM641.1	Describe the basic concepts and challenges of Robotic Process Automation						
22AIM641.2	Apply UiPath Studio to automate processes using Lean Six Sigma and Task Recorder.						
22AIM641.3	Demonstrate the ability to create workflows and perform data manipulation using UiPath.						

22 A IM641 4	Analyze and implement various techniques for interacting with user
227111071.7	interfacecontrols using UiPath.
22 A TM641 5	Evaluate and apply methods for exception handling, debugging, and
22A1101041.3	loggingwithin RPA projects.
22 A TM641 6	Design and develop a comprehensive RPA project that integrates the
22A1101041.0	foundational concepts, workflow design and error management skills.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Tex	tbooks			I
1	TheRoboticProcessAutomationHandbook:AGuide to ImplementingRPASystemsSystemsSystems	Tom Taulli	Apress	1 st Edition, 2020
2	Learning Robotic Process Automation	Alok Mani Tripathi	Packt Publishing	1 st Edition, 2018
Refe	erence Books			
1	Introduction to RoboticProcess Automation :A Primer	Frank Casale, Rebecca Dilla, Heidi Jaynes, Lauren Livingston	The Institute for Robotic Process Automation (IRPA)	2018
2	RoboticProcessAutomation: Guide ToBuildingSoftwareRobots, AutomateRepetitive Tasks& Become An RPA Consultant	Richard Murdoch	Richard Murdoch & RPAUltra	2020
3	Robotic Process Automation Tools, ProcessAutomation and their benefits: Understanding RPA and Intelligent Automation	Srikanth Merianda	Consulting Opportunity Holdings Llc	1 st Edition, 2018

- https://www.youtube.com/watch?v=tMo3wXKbxuw
- https://www.youtube.com/watch?v=007xRS2_JnI
- https://www.youtube.com/watch?v=NzamfhBthao
- https://www.youtube.com/watch?v=m7r2TRT2ESc
- https://www.youtube.com/watch?v=QaPTqO_ypGE

	Course Articulation Matrix													
Course		Program Outcomes												
Outcomes							(P)	Us)						
(COs)										0	1	7	1	5
	01	202	503	04	02	00	207	08	60	01	01	01	OSC	oso
	H	H	H	H	H	H	Ι	Η	I	I	Ι	H	I	I
22AIM641.1	3	2						1					3	
22AIM641.2		3	2		2									
22AIM641.3	3		3				1							
22AIM641.4			2	3					1					2
22AIM641.5			2		3	1								
22AIM641.6	2		3						3	2			3	3

Blockchain Technology									
Course Code	22AIM642	CIE Marks	50						
Course Type	Theory	SEE Marks	50						
(Theory/Practical/Integrated)	Theory	Total Marks	100						
Teaching Hours/Week (L:T:P)	3:0:0	SEE	3 Hours						
Total Hours	40 Hours	Credits	03						

- Understand basic of Blockchain Technology
- Explain Bitcoins and Alternative coins used in Blockchain
- Describe the idea of Ethereum Blockchain and Smart Contract
- Explore Solidity Programming language and Remix IDE to develop smart contract.
- Understand Hyperledger fabric and its framework

Module-1 Introduction (8 hours)

Blockchain 101: Distributed systems, History of blockchain, Introduction to blockchain, Types of blockchain, CAP theorem and blockchain, Benefits and limitations of blockchain.

Decentralization: Decentralization using blockchain, Methods of decentralization, Routes to decentralization, Decentralized organizations. **TB1:** Ch 1, 2

Module-2 Bitcoin (8 hours)

Bitcoin: Introduction to Bitcoin, Digital keys and Addresses, Transactions, Blockchain, Mining **Alternative Coins**: Theoretical foundations, Bitcoin limitations, Namecoin, Litecoin, Primecoin, Zcash. **TB1:** Ch 5, 8

Module-3 Ethereum 101 (8 hours)

Smart Contracts and Ethereum 101:Smart Contracts: Definition, Ricardian contracts. Ethereum 101: Introduction, Ethereum blockchain, Elements of the Ethereum blockchain Precompiled contracts. TB1: Ch 9, 10

Module-4 Development Tools and Frameworks (8 hours)

Development Tools and Frameworks: Languages, Compilers, Solidity compiler (solc) Installation on Linux, Installation on macOS, Integrated Development Environments (IDEs), Tools and libraries, Ganache MetaMask, Truffle Installation, Contract development and deployment. **Introducing solidity:** Types, Value types, Literals, Enums, Function types, Reference types, Global variables, Control structures, Layout of a solidity source code file. **TB1: Ch 13**

Module-5 Hyperledger Fabric (8 hours)

Hyperledger Fabric: Building on the foundations of open computing, Fundamentals of the Hyperledger project, The Linux Foundation, Hyperledger, Open source and open standards, Hyperledger frameworks, tools, and building blocks, Hyperledger Fabric component design, Principles of Hyperledger design, Hyperledger Fabric reference architecture, Hyperledger Fabric runtime architecture, Strengths and advantages of componentized design.

Blockchain-Outside of Currencies: Internet of Things, Government, Health, Finance, Media Exploring. TB1: Ch 17 TB2: Ch 2

Course Outcom	Course Outcomes: At the end of the course the student will be able to:									
22AIM642.1	2AIM642.1 Explain the fundamental building blocks of Blockchain technology.									
22AIM642.2	Discuss the concepts of Bitcoin and their usage in various blockchain applications.									
22AIM642.3	Use the concept of smart contracts and Ethereum and their application in various applications									
22AIM642.4	Execute smart contract using Solidity, Remix IDE and Ethereum frameworks.									
22AIM642.5	Analyze Hyperledger fabric including its framework, design principles and architecture									

22AIM642.6

Develop block chain-based solutions by using the concepts learnt to solve realworld problems.

SI.	Title of the Book	Name of the	Name of the	Edition and
No.		Author/s	Publisher	Year
Text	books			•
1.	Mastering Blockchain - Distributed ledgers, decentralization and smart contracts explained	Imran Bashir	Packt Publishing Ltd	2 nd Edition, 2017
2.	Hands-On Block Chain with Hyperledger: Building Decentralized Applications with Hyperledger Fabric and Composer	Salman Baset, Luc Desrosiers, Nitin Gaur, Petr Novotny,Anthony O'Dowd, Venkatraman Ramakrishna	Packt Publishing Ltd	1 st Edition, 2018
Refe	rence Books			
1.	Blockchain Technology (Concepts and applications)	Kumar saurabh, Ashutosh saxena,	Wiley	First Edition, 2020
2.	Bitcoin and Cryptocurrency Technologies	Arvind Narayanan, Joseph Bonneau, Edward	Princeton University Press	1 st Edition, 2016
3.	Blockchain Basics: A Non- Technical Introduction in 25 Steps	Daniel Drescher	Apress	1 st Edition, 2017
4.	Mastering Bitcoin: Unlocking Digital Cryptocurrencies	Andreas M. Antonopoulos	O'Reilly Media	1 st Edition, 2014

Web links and Video Lectures (e-Resources):

- <u>https://nptel.ac.in/courses/106105184/</u>
- blockgeeks.comguide/what-is-block-chain-technology https://nptel.ac.in/courses/106105184/
- https://www.coursera.org/specializations/blockchain
- <u>https://www.geeksforgeeks.org/blockchain/</u>
- <u>https://www.tutorialspoint.com/blockchain/index.htm</u>
- <u>https://www.youtube.com/watch?v=AWPisuBx1Zo</u>
- <u>https://www.youtube.com/watch?v=SyVMma1IkXM</u>

Course Articulation Matrix

Course					F	Progra	m Ou	tcome	es (PO	s)				
(COs)	P01	P02	PO3	P04	P05	904	P07	80d	60d	PO10	1104	P012	10S4	PSO2
22AIM642.1	2	1				1							1	
22AIM642.2	1	2	1		1			1						
22AIM642.3	1			2									2	
22AIM642.4		1	2	1	2			1						
22AIM642.5	2	1		1	2	1							2	
22AIM642.6			1	1	2			2						

Predictive Analytics											
Course Code	22AIM643	CIE Marks	50								
Course Type	Theory	SEE Marks	50								
(Theory/Practical/Integrated)	Theory	Total Marks	100								
Teaching Hours/Week (L:T:P)	3:0:0	SEE	3 Hours								
Total Hours	40 Hours	Credits	03								

- Learn, how to develop models to predict categorical and continuous outcomes, using such techniques as neural networks, decision trees, logistic regression, support vector machines and Bayesian network models.
- Know the use of the binary classifier and numeric predictor nodes to automate model selection.
- Be familiar with when and how to use each model.
- Learn how to combine two or more models to improve prediction.
- Understand how analytics provided a solution to industries using real case studies

Module-1 Linear Regression and Classification (8 hours)

Overview of Supervised Learning, what is statistical learning, Linear Methods for Regression, Simple Linear regression, Multiple Linear Regression, Multiple outputs, Other Considerations in the Regression Model, Logistic Regression, Linear Discriminant Analysis, A Comparison of Classification Methods.

TB1: Ch 2, 3 TB2: Ch 1, 3, 4

Module-2 Model Assessment and Selection (8 hours)

Bias, Variance, and model complexity, Bias-variance trade off, Optimism of the training error rate Estimate of In-sample prediction error, Effective number of parameters, Bayesian approach and BIC, Cross- validation, Boot strap methods, conditional or expected test error. Resampling Methods: Cross-Validation, The Bootstrap, Subset Selection, Shrinkage Methods **TB1: Ch 7, TB2: Ch 5, 6**

Module-3 Additive Models, Trees and Boosting (8 hours)

Generalized additive models, Tree-Based Methods, MARS: Multivariate Adaptive Regression Splines, Hierarchical Mixtures of Experts, Boosting Methods, The Basics of Decision Trees, Boosting Trees, Numerical Optimization via Gradient Boosting, Regularization, Right-Sized Trees for Boosting, Bagging, Random Forests, Boosting **TB1: Ch 9, TB2: Ch 8**

Module-4 Neural Networks (NN), Support Vector Machines (SVM), and K-nearest Neighbor (8 hours)

Fitting neural networks, Back propagation, Issues in training NN, The Support Vector Classifiers, SVM and kernels, Support Vector Machines, SVMs with More than Two Classes, Relationship to Logistic Regression, Flexible Discriminant Analysis, Penalized Discriminant Analysis, Mixture Discriminant Analysis.

TB1: Ch 11, 12 TB2 Ch 9

Module-5 Unsupervised Learning and Random forests (8 hours)

Association rules, Cluster analysis, Principal Components, Definition of Random Forests, Random forests and analysis. Clustering Methods, NCI60 Data Example, Independent Component Analysis, Learning Ensembles. Markov Graphs and Their Properties **TB1 Ch 14, 15, 16 TB2 Ch 10**

Course Outcomes: At the end of the course the student will be able to:										
22AIM643.1	Demonstrate the process of formulating business objectives, data selection/collection, preparation and process to successfully design, build, evaluate and implement predictive models for a various business application.									
22AIM643.2	Compare the underlying predictive modeling techniques.									

22AIM643.3	Select appropriate predictive modeling approaches to identify cases to progresswith.
22AIM643.4	Apply predictive modeling approaches using a suitable package such as SPSSModeler
22AIM643.5	Analyze and explore data to better understand relationships among variables
22AIM643.6	Analyze the performance of these models with holdout data & apply predictivemodels to generate predictions for new data

Sl.	Title of the Book	Name of the	Name of the	Edition and
No.	The of the book	Author/s	Publisher	Year
Text	books			
1	The Elements of Statistical Learning- Data Mining, Inference, and Prediction	Trevor Hastie, Robert Tibshirani, Jerome Friedman	Springer Verlag,	2 nd Edition, 2009
2	An introduction to statistical learning with applications in R	G.James,D.Witten, T.Hastie,R.Tibshir ani	Springer	1 st Edition, 2013
Refe	rence Books			
1	Pattern Recognition and Machine Learning	C.M.Bishop	Springer	1 st Edition, 2006
2	All of statistics	L.Wasserman	Springer	1 st Edition, 2004
3	Predictive & Advanced Analytics	-	(IBM ICE Publication)	-

- https://www.techtarget.com/searchbusinessanalytics/definition/predictive-analytics
- <u>https://www.youtube.com/watch?v=Kd0C-8q0HkI</u>
- <u>https://www.cio.com/article/228901/what-is-predictive-analytics-transforming-data-into-future-insights.html</u>
- <u>https://www.conestogac.on.ca/fulltime/predictive-analytics</u>
- <u>https://www.youtube.com/watch?v=Cx8Xie5042M</u>
- https://www.youtube.com/watch?v=1xw915rbyG4

Course Articulation Matrix

Course					P	rogra	m Ou	tcome	es (PC)s)				
(COs)	P01	P02	PO3	P04	504	90d	707	80d	60d	P010	P011	P012	10Sd	PSO2
22AIM643.1	1												1	
22AIM643.2	2	1		1										
22AIM643.3	1	2		1									2	1
22AIM643.4													2	1
22AIM643.5	1	3			3								1	2
22AIM643.6		1	1					1	1	2				1

High Performance Computing												
Course Code	22AIM644	CIE Marks	50									
Course Type	Theory	SEE Marks	50									
(Theory/Practical/Integrated)	Theory	Total Marks	100									
Teaching Hours/Week (L:T:P)	3:0:0	SEE	3 Hours									
Total Hours	40 Hours	Credits	03									

- Understand the scope and challenges of parallel computing in modern computing environments.
- Learn the principles of parallel algorithm design to decompose tasks and manageinteractions in parallel systems.
- Understand the concept of groups and communicators in message passing paradigms.
- Know thread basics and synchronization primitives in shared address space platforms.
- Understand the concepts of GPU and CUDA

Module-1 Introduction and Parallel Programming Platforms(8 hours)

Introduction to Parallel Computing: Motivating Parallelism, Scope of Parallel Computing. **Parallel Programming Platforms:** Implicit Parallelism: Trends in Microprocessor Architectures, Limitations of Memory System Performance, Dichotomy of Parallel Computing Platforms, Physical Organization of Parallel Platforms, Communication Costs in Parallel Machines, Routing Mechanisms for Interconnection Networks, Impact of Process-Processor Mapping and Mapping Techniques. **TB1: Ch 1.1, 1.2, Ch2.1 – 2.7**

Module-2 Principles of Parallel Algorithm Design and Communication operations (8 hours)

Principles of Parallel Algorithm Design: Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods for Containing Interaction Overheads. **Basic Communication operations:** One-to-All Broadcast and All-to-One Reduction, Allto-All Broadcast and Reduction, All-Reduce and Prefix-Sum Operations, Scatter and Gather, All-to-All Personalized Communication, Circular Shift, Improving the Speed of Some Communication Operations. **TB1: Ch 3, Ch 4.**

Module-3 Analytical Modeling and Message-Passing Paradigm (8 hours)

Analytical Modeling of Parallel Systems: Sources of Overhead in Parallel Programs, Performance Metrics for Parallel Systems, The Effect of Granularity on Performance, Scalability of Parallel Systems. Minimum Execution Time and Minimum Cost-Optimal Execution Time, Asymptotic Analysis of Parallel Programs. **Programming using the Message-Passing Paradigm:** Principles of Message-Passing Programming, The Building Blocks: Send and ReceiveOperations, MPI: the Message Passing Interface, Topologies and Embedding, Overlapping Communication with Computation, Collective Communication and Computation Operations, Groups and Communicators. **TB1: Ch 5, Ch 7.**

Module-4 Shared Address Space Platforms (8 hours)

Programming Shared Address Space Platforms: Thread Basics, Why Threads?, The POSIX Thread API, Thread Basics: Creation and Termination, Synchronization Primitives in Pthreads, Controlling Thread and Synchronization Attributes, Thread Cancellation, 08 Composite Synchronization Constructs, Tips for Designing Asynchronous Programs. **Dense Matrix Algorithms:** Matrix-Vector Multiplication, Matrix-Matrix Multiplication. **Solving a System of Linear Equations Sorting:** Issues in Sorting on Parallel Computers, Sorting Networks, Bucket and Sample Sort. **TB1:** Ch 6, Ch 8, Ch 9.

Module-5 GPU and CUDA(8 hours)

GPU and CUDA: GPUs as Parallel Computers, Architecture of a Modern GPU, Evolution of Graphics Pipelines, GPU Computing, CUDA Program Structure, Device Memories and Data Transfer, Kernel Functions and Threading, CUDA Thread Organization, Using blockIdx and threadIdx, Synchronization and Transparent Scalability. **TB2:** Ch 1.1, 1.2, Ch 2,3, Ch 4.1-4.3

Course Outco	Course Outcomes: At the end of the course the student will be able to:								
22AIM644.1	Describe the principles of parallel computing.								
22AIM644.2	Illustrate various parallel programming models and their implementation.								
22AIM644.3	Identify the need for performance optimization for parallel applications.								
22AIM644.4	Demonstrate programming shared memory platforms, including thread basics, synchronization primitives, and dense matrix algorithms.								
22AIM644.5	Apply the CUDA programming for high-performance parallel computing, enabling scalable and optimized solutions for complex computational tasks.								
22AIM644.6	Analyze the graph algorithms for solving discrete optimization problems.								

Sl.	Title of the Book	Name of the	Name of the	Edition
No.	The of the book	Author/s	Publisher	and Year
Text	books			
1	Introduction to Parallel Computing	AnanthGrama, Anshul Gupta, George Karypis, and Vipin Kumar	Addison- Welsey	2 nd Edition, 2013
2	Programming Massively Parallel Processors: A Hands- On Approach	David B. Kirk and Wen-mei W. Hwu.	Elsevier India Ltd. Pvt.	1 st Edition, 2010.
Refe	rence Books			
1	ParallelProgramming:TechniquesandApplicationsUsingNetworkedWorkstationsandParallelComputers	Wilkinson and M. Allen,	Prentice Hall	2 nd Edition, 2006
2	Parallel Programming in C with MPI and OpenMP	M.J. Quinn	McGraw- Hill	1 st Edition, 2017

- <u>https://nptel.ac.in/courses/106108055</u>
 <u>https://www.cs.purdue.edu/homes/ayg/book/Slides/</u>

Course	Program Outcomes (POs)													
Outcomes (COs)	P01	P02	£O4	P04	504	90d	LOJ	80d	60d	P010	P011	P012	PSO1	PSO2
22AIM644.1	1	2	1										1	
22AIM644.2		2	1										1	2
22AIM644.3	1	2	2										1	
22AIM644.4		2	2										1	2
22AIM644.5		2	2										1	
22AIM644.6			2										2	

1: Low 2: Medium 3: High

Introduction to AI and ML								
Course Code	22AIM651	CIE Marks	50					
Course Type	Theory	SEE Marks	50					
(Theory/Practical/Integrated)	Theory	Total Marks	100					
Teaching Hours/Week (L:T:P)	3:0:0	SEE	3 Hours					
Total Hours	40 Hours	Credits	03					

- Gain the historical perspective of AI and its foundations.
- Become familiar with basic principles of AI toward problem solving.
- Understand the basics of Machine Learning with the basics of Concept learning.
- Apply the basics of Similarity-Based learning and Decision Tree learning.
- Apply the basics of Bayesian learning and Artificial Neural Networks.

Module-1 Basics of AI (8 hours)

What is AI, The foundation of Artificial Intelligence, The history of Artificial Intelligence, Intelligent Agents: Agents and Environments, Good Behaviour: The concept of rationality, the nature of Environments, the structure of Agents.

TB1: Ch 1, 2

Module-2 Searching and Solving (8 hours)

Problem solving agents, Example problems, Searching for solutions, Uninformed search strategies, Informed search strategies, Heuristic functions **TB 1: Ch 3**

Module-3 Basics of ML (8 hours)

Introduction to Machine Learning: Need for Machine Learning, Machine Learning Explained, and Machine Learning in relation to other fields, Types of Machine Learning. Challenges of Machine Learning, Machine Learning process, Machine Learning applications. **Basics of Learning Theory:** Introduction to learning and its types, Introduction computational learning theory, Design of learning system, Introduction concept learning.

TB 2: Ch 1, 3

Module-4 Similarity Based and Decision Tree Learning (8 hours)

Similarity-based learning: Introduction to Similarity or instance based learning, Nearestneighbor learning, weighted k- Nearest - Neighbour algorithm.

Decision Tree Learning: Introduction to Decision Tree Learning Model, Decision Tree Induction Algorithms, Validating and Pruning of Decision Trees .

TB 2: Ch 4, Ch 6

Module-5 Neural Networks (8 hours)

Bayesian Learning: Introduction to Probability-based Learning, Fundamentals of Bayes Theorem, Classification Using Bayes Model.

Artificial Neural Network: Introduction, Artificial neurons, Types of Artificial Neural Networks, Popular Applications of Artificial Neural Networks, Advantages and Disadvantages of ANN, Challenges of Artificial Neural Networks

TB 2: Ch 8, Ch 10

Course Outcomes: At the end of the course the student will be able to:					
22AIM651.1	Describe the fundamentals of AI.				
22AIM651.2	Demonstrate searching and problem-solving techniques.				
22AIM651.3	Identify the need for machine learning tasks for solving various problems.				
22AIM651.4	Choose Similarity Based and Decision Tree Learning for various tasks.				
22AIM651.5	Apply Baye's algorithm for classification task and comprehend ANN learning and its applications.				

	Analyze	AI	concepts,	problem-solving	techniques,	Machine	Learning
22AIM651.6	algorithm	s, an	d Decision '	Tree Learning meth	nods and ANN	Ns to real-w	vorld
	problems	and s	scenarios.				

Sl.	Title of the Book	Name of the	Name of the	Edition and
No.	The of the book	Author/s	Publisher	Year
Text	books			
1	Artificial Intelligence	Stuart J. Russell and Peter Norvig	Pearson Education	3 rd Edition 2015
2	Machine Learning	S. Sridhar, M Vijayalakshmi Oxford		2021
Refe	rence Books			
1	Artificial Intelligence Structure and Strategies	George F Luger	Pearson Education	3 rd Edition 2000
2	Machine Learning	Tom Mitchell	McGrawHill Publication	2013

- Artificial Intelligence Overview (tutorialspoint.com)
- <u>Problem-solving in Artificial Intelligence TAE (tutorialandexample.com)</u>
- Decision Tree Tutorials & Notes | Machine Learning | HackerEarth
- History of Artificial Intelligence Javatpoint
- Heuristic Search Techniques in Artificial Intelligence TechVidvan

Course Articulation Matrix

Course		Program Outcomes (POs)												
(COs)	10d	P02	£04	P04	504	90d	707	PO8	60d	PO10	P011	P012	PS01	PSO2
22AIM651.1	1												1	
22AIM651.2		2	2										2	
22AIM651.3	1		2										1	
22AIM651.4		2	2										2	
22AIM651.5	1		2										1	
22AIM651.6			2											

1: Low	2: Medium	3:	High
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Introduction to Data Science								
Course Code	22AIM652	CIE Marks	50					
Course Type	Theory	SEE Marks	50					
(Theory/Practical/Integrated)	Theory	Total Marks	100					
Teaching Hours/Week (L:T:P)	3:0:0	SEE	3 Hours					
Total Hours	40 Hours	Credits	03					

- Introduce data collection and pre-processing techniques for data science.
- Explore analytical methods for solving real life problems through data exploration techniques.
- Illustrate different types of data and its visualization.
- Find different data visualization techniques and tools.
- Design and map elements of visualization well to perceive information.

Module-1 Preparing and Gathering Data (8 hours)

Philosophies of data science - Data science in a big data world - Benefits and uses of data science and big data - facts of data: Structured data, Unstructured data, Natural Language, Machine generated data, Audio, Image and video streaming data.

TB 1: Ch 1

Module-2 The Data Science Process (8 hours)

Overview of the data science process- defining research goals and creating project charter, retrieving data, cleansing, integrating and transforming data, exploratory data analysis, Build the models, presenting findings and building application on top of them.

TB 1: Ch 2

Module-3 Machine Learning (8 hours)

Application for machine learning in data science- Tools used in machine learning Modeling Process – Training model – Validating model – Predicting new observations –Types of machine learning Algorithm : Supervised learning algorithms, Unsupervised learning algorithms

TB 1: Ch 3

Module-4 Visualization (8 hours)

Introduction to data visualization – Data visualization options – Filters – MapReduce – Dashboard development tools.

TB 1: Ch 9

Module-5 Big Data (8 hours)

The Big data Ecosystem: Distributed file system, Distributed Programming framework, Data Integration framework, Machine learning Framework, NoSQL Databases, Scheduling tools, Benchmarking Tools, System Deployment, Service programming and Security. Distributing data storage and processing with frameworks - **Case study**: e.g, Assessing risk when lending money **TB 1: Ch 5**

Course Outcom	es: At the end of the course the student will be able to:
22AIM652.1	Explain the data science terminologies.
22AIM652.2	Describe the Data Science process for real time scenario
22AIM652.3	Illustrate Basic Machine Learning Algorithms used to perform data science related tasks.
22AIM652.4	Make use of data visualization tools for demonstrating patterns or trends in the result.
22AIM652.5	Apply Data storage and processing with frameworks for Bigger dataset.
22AIM652.6	Analyze various Data Science tools for real-life applications.

Sl.	Title of the Book	Name of the	Name of the	Edition and	
No.		Author/s	Publisher	Year	
Text	books				
1	Introducing Data Science	Davy Cielen,ArnoD. B. Meysmanand Mohamed AliPublications		1 st Edition, 2016	
Refe	rence Books				
1	Doing Data Science	Cathy O'Neil, Rachel Schutt, O' Reilly	O'Reilly Media	1 st Edition, 2013	
2	Think Like a Data Scientist	Brian Godsey	Manning Publications	1 st Edition, 2017	
3	Mining of Massive Datasets	Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman	Cambridge University Press	2 nd Edition, 2014	

- https://www.simplilearn.com/tutorials/data-science-tutorial/what-is-data-science
- https://www.simplilearn.com/tutorials/data-science-tutorial/what-is-data-science
- https://www.coursera.org/lecture/what-is-datascience/fundamentals-of-data-science-tPgFU
- Learn Data Science Tutorial Full Course for Beginners YouTube
- https://www.simplilearn.com/tutorials/data-science-tutorial/what-is-data-science

Course	Program Outcomes (POs)													
(COs)										•	_		1	2
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P01(P011	P012	PSO	PSO
22AIM652.1	1			2	3									2
22AIM652.2				2		3								2
22AIM652.3				2										
22AIM652.4				2		1								
22AIM652.5				2	2							2		
22AIM652.6				2	2	1						3		2

Course Articulation Matrix

Introduction to Computer Vision								
Course Code	22AIM653	CIE Marks	50					
Course Type	Theory	SEE Marks	50					
(Theory/Practical/Integrated)	Theory	Total Marks	100					
Teaching Hours/Week (L:T:P)	3:0:0	SEE	3 Hours					
Total Hours	40 Hours	Credits	03					

- Learn basic principles of image formation, image processing algorithms.
- Understand the core vision tasks of scene understanding and recognition.
- Choose the appropriate segmentation and clustering techniques for vision modeling.
- Apply different vision levels for image/video analysis, object recognition in building a computer vision model.

Module-1 Introduction to Computer Vision (8 hours)

Overview of computer vision and its applications: Image Formation and Representation: Imaging geometry, radiometry, digitization, cameras and Projections, rigid and affine transformation **TB1: Ch-1.1 to 1.3**

Module-2 Image Processing (8 hours)

Image Processing: Pixel transforms, color transforms, histogram processing, histogram equalization, filtering, convolution, Fourier transformation and its applications in sharpening, blurring and noise removal.

TB2: Ch 3 - 3.2 to 3.6 and Ch 4 - 4.2, 4.5 to 4.10

Module-3 Object recognition and Feature detection (8 hours)

Object recognition and shape representation: alignment, appearance-based methods, invariants, image eigenspaces

Feature detection: edge detection, corner detection, line and curve detection, active contours, SIFT and HOG descriptors, shape context descriptors, Morphological operations.

TB1: Ch -17, Ch -18

Module-4 Segmentation (8 hours)

Segmentation: Active contours, split & merge, watershed, region splitting, region merging, graphbased segmentation, mean shift and model finding, Normalized cut.

TB1: Ch -9.2, 9.4, 9.5

Module-5 Image Registration (8 hours)

Registration: Registering Rigid Objects, with Projection, Registering Deformable Objects. Smooth Surface and their Outlines: Elements of Differential Geometry, Contour Geometry. **TB1: Ch 12.1 to 12.3**

Course Outcomes: At the end of the course the student will be able to:					
22AIM653.1	Describe the fundamental image processing techniques required for computer vision.				
22AIM653.2	Explain Image formation process.				
22AIM653.3	Identify appropriate object recognition and shape analysis techniques.				
22AIM653.4	Compare different segmentation techniques.				
22AIM653.5	Make use of image registration techniques.				
22AIM653 .6	Analyze the use of computer vision techniques in real-life applications.				

Sl.	Title of the Book	Name of the	Name of the	Edition and	
No.	The of the book	Author/s	Publisher	Year	
Text	books				
1	Computer Vision – A modern approach	D. Forsyth and J. Ponce	Prentice Hall	2 nd Edition, 2012	
2	Digital Image Processing	Rafael C. Gonzalez and Richard E. Woods	Prentice Hall	4 th Edition, 2018	
Refe	rence Books				
BuildingComputerVisionApplicationsUsingArtificialNeuralNetworks - WithStep-by-stepExamplesinOpencvandTensorflowPythonNeuralNeural		Shamshad Ansari	Apress	1 st Edition, 2020	
2	Computer Vision: Models, Learning, and Inference	Simon J. D. Prince	Cambridge University Press	1 st Edition, 2012	

- <u>https://youtu.be/V_xro1bcAuA?si=otfZ_1VYInB6tz1W</u>
- https://www.udacity.com/course/introduction-to-computer-vision--ud810
- https://www.mygreatlearning.com/academy/learn-for-free/courses/computer-vision-essentials
- <u>https://www.mltut.com/best-free-computer-vision-courses/</u>
- https://www.youtube.com/watch?v=D5hmApvpLH4
- https://www.youtube.com/watch?v=01sAkU_NvOY

Course					P	rogra	m Ou	tcome	es (PO	s)				
(COs)	P01	P02	£03	P04	504	90d	707	P08	60d	PO10	P011	P012	FSO1	PSO2
22AIM653 .1	2											2		2
22AIM653.2		2	2										2	
22AIM653.3						2						2		
22AIM653.4		2	2	2	2	1	2	1						
22AIM653.5				1	2	1			1	2	2			
22AIM653.6			1		1				2	2	2			2

Course Articulation Matrix

1: Low 2: Medium 3: High

Predictive Analytics									
Course Code	22AIM654	CIE Marks	50						
Course Type	Theory	SEE Marks	50						
(Theory/Practical/Integrated)	Theory	Total Marks	100						
Teaching Hours/Week (L:T:P)	3:0:0	SEE	3 Hours						
Total Hours	40 Hours	Credits	03						

- Learn, how to develop models to predict categorical and continuous outcomes, using such techniques as neural networks, decision trees, logistic regression, support vector machines and Bayesian network models.
- Know the use of the binary classifier and numeric predictor nodes to automate model selection.
- Be familiar when and how to use each model and Learn how to combine two or more models to improve prediction.
- Understand how analytics provided a solution to industries using real case studies.

Module-1 Linear Regression and Classification (8 hours)

Overview of Supervised Learning, what is statistical learning, Linear Methods for Regression, Simple Linear regression, Multiple Linear Regression, Multiple outputs, Other Considerations in the Regression Model, Logistic Regression, Linear Discriminant Analysis, A Comparison of Classification Methods. **TB1: Ch 2, 3 TB2: Ch 1, 3, 4**

Module-2 Model Assessment and Selection (8 hours)

Bias, Variance, and model complexity, Bias-variance trade off, Optimism of the training error rate Estimate of In-sample prediction error, Effective number of parameters, Bayesian approach and BIC, Cross- validation, Boot strap methods, conditional or expected test error. Resampling Methods: Cross-Validation, The Bootstrap, Subset Selection, Shrinkage Methods. **TB1: Ch 7, TB2: Ch 5, 6**

Module-3 Additive Models, Trees and Boosting (8 hours)

Generalized additive models, Tree-Based Methods, MARS: Multivariate Adaptive Regression Splines, Hierarchical Mixtures of Experts, Boosting Methods, The Basics of Decision Trees, Boosting Trees, Numerical Optimization via Gradient Boosting, Regularization, Right-Sized Trees for Boosting, Bagging, Random Forests, Boosting. **TB1: Ch 9, TB2: Ch 8**

Module-4 Neural Networks (NN), Support Vector Machines (SVM), and K-nearest Neighbor (8 hours)

Fitting neural networks, Back propagation, Issues in training NN, The Support Vector Classifiers, SVM and kernels, Support Vector Machines, SVMs with More than Two Classes, Relationship to Logistic Regression, Flexible Discriminant Analysis, Penalized Discriminant Analysis, Mixture Discriminant Analysis. **TB1: Ch 11, 12 TB2: Ch 9**

Module-5 Unsupervised Learning and Random forests (8 hours)

Association rules, Cluster analysis, Principal Components, Definition of Random Forests, Random forests and analysis. Clustering Methods, NCI60 Data Example, Independent Component Analysis, Learning Ensembles. Markov Graphs and Their Properties. **TB1: Ch 14,15,16 TB2: Ch 10**

Course Outcomes: At the end of the course the student will be able to:									
22AIM654.1	Demonstrate the process of formulating business objectives, data selection/collection, preparation and process to successfully design, build, evaluate and implement predictive models for a various business application.								
22AIM654.2	Compare the underlying predictive modeling techniques.								

22AIM654.3	Select appropriate predictive modeling approaches to identify cases to progresswith.
22AIM654.4	Apply predictive modeling approaches using a suitable package such as SPSSModeler
22AIM654.5	Choose data and identify relationships among variables
22AIM654.6	Analyze the performance of the models with holdout data and apply predictivemodels to generate predictions for new data

Sl.	Title of the Book	Name of the	Name of the	Edition and
No.	The of the book	Author/s	Publisher	Year
Text	books			
1	The Elements of Statistical Learning-Data Mining, Inference, and	Trevor Hastie, Robert Tibshirani, Jerome Friedman	Springer Verlag,	2 nd Edition, 2009
2	An introduction to statistical learning with applications in R	G.James,D.Witten, T.Hastie,R. Tibshirani	Springer	1 st Edition, 2013
Refe	rence Books			
1	Pattern Recognition and Machine Learning	C.M.Bishop	Springer	1 st Edition, 2006
2	All of statistics	L.Wasserman	Springer	1 st Edition, 2004
3	Predictive & Advanced Analytics		(IBM ICE Publication)	

- https://www.techtarget.com/searchbusinessanalytics/definition/predictive-analytics
- <u>https://www.youtube.com/watch?v=Kd0C-8q0HkI</u>
- <u>https://www.cio.com/article/228901/what-is-predictive-analytics-transforming-data-into-future-insights.html</u>
- <u>https://www.conestogac.on.ca/fulltime/predictive-analytics</u>
- <u>https://www.youtube.com/watch?v=Cx8Xie5042M</u>
- https://www.youtube.com/watch?v=1xw915rbyG4

Course Articulation Matrix

Course		Program Outcomes (POs)												
(COs)	101	P02	P03	P04	P05	904	20d	80d	60d	P010	P011	P012	PSO1	PSO2
22AIM654.1	1												1	
22AIM654.2	2	1		1										
22AIM654.3	1	2		1									2	1
22AIM654.4													2	1
22AIM654.5	1	3	2		3								1	2
22AIM654.6		1	1					1	1	2				1

	Major Project Pha	se I	
Course Code	22AIM66	CIE Marks	100
Course Type		SEE Marks	-
(Theory/Practical/Integrated)	Practical	Total Marks	100
Teaching Hours/Week (L:T:P)	(0:0:4)	SEE	-
Total Hours	48 hours	Credits	02
Course Learning Objectives:			

5. Utilize fundamental principles of engineering and interdisciplinary knowledge to identify, analyse, and solve complex problems in the project domain.

- 6. Develop and execute a comprehensive project plan that includes designing, prototyping, testing, and evaluating a system, component, or process to meet specific needs and constraints.
- 7. Conduct in-depth research, critically review literature, and integrate innovative solutions or techniques within the project framework.
- 8. Demonstrate effective teamwork, communication, and collaboration skills in a multidisciplinary environment to achieve project objectives.
- 9. Incorporate ethical considerations, societal impact, and sustainable practices in the project development, while adhering to professional engineering standards.
- 10. Prepare and present a well-structured project report, supported by technical documentation and visual aids, and confidently defend the work during project viva-voce or presentations.

1. Project Selection

- **Relevance**: Projects should align with the students' specialization and current industry trends.
- **Innovation**: Projects that offer innovative solutions to existing problems or explore new ideas are encouraged.
- **Feasibility**: The project should be achievable within the given timeframe and resources.
- **Team Composition**: Students can work in teams, typically comprising maximum 4 members.

2. Project Proposal

- **Submission**: Students must submit a detailed project proposal (project synopsis) outlining the problem statement, objectives, methodology, expected outcomes, and a work plan.
- **Approval**: The proposal should be reviewed and approved by the Department Project Evaluation Committee (DPEC).

3. Project Execution

- **Regular Meetings**: Students should meet regularly with their project-guide to discuss progress, challenges, and next steps.
- **Documentation**: Maintain detailed documentation throughout the project in a project workdairy, including design decisions, experiments, and testing results.
- **Milestones**: Set clear milestones and deadlines to ensure steady progress. These could include design completion, initial prototype, testing, etc.

4. Mid-term Review

- **Progress Presentation**: DPEC shall conduct a mid-term review where students present their progress to a panel of faculty members.
- Feedback: Provide constructive feedback and guidance to help students refine their projects.

5. Report Submission

- **Report**: The project report should include an abstract, introduction, literature review, methodology, completed portion of the project work with the available results, discussion, conclusion, and references.
- Code and Data: If applicable, students should submit their code, datasets, and any other relevant materials.

6. Project Presentations

• **Oral Presentation**: Students should present their projects to a panel, explaining their work, findings, and contributions.

- **Demonstration**: If possible, include a live demonstration of the project or show relevant simulations and results.
- **Q&A**: Be prepared to answer questions from the panel and justify the project's methodology and conclusions.

7. Evaluation Criteria

- Originality and Innovation: Assess the novelty and creativity of the project.
- **Technical Competence**: Evaluate the depth of technical knowledge and problem-solving ability demonstrated.
- **Project Execution**: Consider the effectiveness of project planning, adherence to timelines, and quality of implementation.
- **Presentation and Communication**: Judge the clarity and coherence of the project report, presentation, and the ability to answer questions.

8. Plagiarism Check

- Academic Integrity: Ensure that the work submitted is original and properly cites all references and sources.
- **Plagiarism Check**: Run all reports through plagiarism detection software and ensure that similarity index is less than the threshold value (25%).

9. Mentorship and Feedback

- **Feedback:** Students are required to consult with their project guide regularly throughout the project work to seek guidance and feedback.
- Weekly Meetings: At least one mentorship meeting every week shall be held and recorded in the project work-dairy.

Continu	Continuous Internal Evaluation (CIE)									
Description	IE Weightage									
Description	r roposed Dates	Max 100 marks)								
1. Project Synopsis Evaluation	Beginning of the 6 th Semester	20 marks								
2. Project Progress Evaluation	Middle of the 6 th Semester	30 marks								
3. Project Report Evaluation	End of the 6 th Somester	50 mortes								
(Phase I)	End of the o Semester	JU IIIdi KS								
Marks given for the Project Repo	rt shall be the same for all project	team members, However,								
marks may differ for presentations and viva-voce depending upon the individual student										

Semester End Examinations (SEE)

There is No SEE component for Major Project Phase I.

performance.

Course Outcome	es: At the end of the course the student will be able to :
22AIM66.1	Demonstrate the ability to identify, define, and solve complex engineering problems using appropriate methodologies and modern tools.
22AIM66.2	Successfully design, develop, and test an engineering solution that meets specified requirements, addressing technical, economic, environmental, and social constraints.
22AIM66.3	Apply research skills to review existing literature, gather and analyze data, and incorporate innovative or state-of-the-art technologies in the project
22AIM66.4	Collaborate effectively within a team, taking on leadership or supportive roles as needed, while ensuring clear communication and efficient project management.
22AIM66.5	Demonstrate awareness of professional ethics, societal impact, and sustainability in the design and implementation of engineering solutions.

22AIM66.6 Exhibit strong written and oral communication skills by preparing technical reports, project documentation, and delivering persuasive project presentations.

Course		Program Outcomes (POs)													
Outcomes (COs)	PO1	P02	P03	P04	PO5	P06	P07	P08	P09	P010	P011	P012	PS01	PSO2	
22AIM66.1	2	3	-	-	1	-	-	-	-	-	-	-	-	-	
22AIM66.2	-	-	3	-	-	2	1	-	-	-	-	-	-	-	
22AIM66.3	1	2	-	3	-	-	-	-	-	-	-	-	-	-	
22AIM66.4	-	-	-	-	-	1	-	-	3	2	2	-	-	-	
22AIM66.5	-	-	1	-	-	-	2	3	-	-	-	-	-	-	
22AIM66.6	-	-	-	-	-	-	-	-	-	3	2	1	-	-	

Course Articulation Matrix

	Environmental Studies		
Course Code	22CIV67	CIE Marks	50
Course Type	Theory	SEE Marks	50
(Theory/Practical/Integrated)	Theory	Total Marks	100
Teaching Hours/Week (L:T:P)	1:0:0	SEE	2 Hours
Total Hours	15 hours	Credits	01

Course Learning Objectives: This course will enable

- To create environmental awareness among the students.
- To gain knowledge on different types of pollution in the environment.

Module-1 Introduction to Ecology (3 hours)

Ecosystems (Structure and Function): Forest, Desert, Wetlands, River, Oceanic, and Lake. Biodiversity: Types, Value; Hot spots; Threats and Conservation of Biodiversity, Forest Wealth, and Deforestation.

Module-2 Energy Systems and Natural Resources (3 hours)

Advances in Energy Systems (Merits, Demerits, Global Status, and Applications): Hydrogen, Solar, OTEC, Tidal, and Wind.

Natural Resource Management (Concept and case studies): Disaster Management, Sustainable Mining, case studies, and Carbon Trading.

Module-3 Environmental Pollution and Public Health (3 hours)

Environmental Pollution (Sources, Impacts, Corrective and Preventive measures, Relevant Environmental Acts, Case-studies): Surface and Ground Water Pollution; Noise pollution; Soil Pollution, and Air Pollution.

Waste Management & Public Health Aspects: Bio-medical Wastes; Solid waste; Hazardous wastes; E-wastes; Industrial and Municipal Sludge.

Module-4 Environmental Concerns (3 hours)

Global Environmental Concerns (Concept, policies, and case studies): Groundwater depletion/recharging, Climate Change; Acid Rain; Ozone Depletion; Radon and Fluoride problems in drinking water; Resettlement and rehabilitation of people, Environmental Toxicology.

Module-5 Environmental Management (3 hours)

Latest Developments in Environmental Pollution Mitigation Tools (Concept and Applications): G.I.S. & Remote Sensing, Environment Impact Assessment, Environmental Management Systems, ISO14001; Environmental Stewardship- NGOs. Fieldwork: A visit to an Environmental Engineering Laboratory or Green Building or Water Treatment Plant or Waste water treatment Plant; thought to be Followed by an understanding of the process and its brief documentation (Optional).

Course Outcomes: At the end of the course the student will be able to:								
22CIV67.1	Identify the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale,							
22CIV67.2	Develop critical thinking and/or observation skills and apply them to the analysis of a problem or question related to the environment.							
22CIV67.3	Demonstrate ecology knowledge of a complex relationship between a biotic and abiotic component.							
22CIV67.4	Apply their ecological knowledge to illustrate and graph a problem and describe the realities that managers face when dealing with complex issues.							
22CIV67.5	Address problems related to waste management and public health aspects							
22CIV67.6	List the Standards and latest tools to mitigate pollution.							

Sl.	Title of the Book	Name of the	Name of the	Edition and	
No.	THE OF HE DOOK	Author/s	Publisher	Year	
Text	books				
1	Environmental studies	Benny Joseph	Tata McGraw-Hill	Edition 3, 2018	
2	Environmental Studies – From Crisis to Cure	R Rajagopalan	Oxford Uni-Press	Edition 3, 2020	
Refer	ence Books				
1	A Basic Course in Environmental Studies	Surinder Deswal, Anupama Deswal	Dhanpat Rai Publishing Co. (P) Ltd	2017	
2	Text book of Environmental Studies for Undergraduate Courses	Bharucha Erach	Universities Press	Edition 2, 2017	
3	Environmental Studies	Ranjit R. J Daniels, Jagdish Krishnaswamy	John Wiley & Sons Inc.	2010	
4	Perspective in Environmental Studies	Anubha Kaushik, C P Kaushik	New Age International Pvt. Ltd	Edition 3, 2009	

- 1. Coursera Course: Introduction to Environmental Science Specialization https://coursera.org/share/e6c3c98f7215fd49f688e7ede71a0dfc
- 2. NPTEL: Environmental Studies https://onlinecourses.swayam2.ac.in/cec22_ge22/preview
- Directory of Open Access Books (DOAB) Environmental Leadership Capacity Building in Higher Education: Experience and Lessons from Asian Program for Incubation of Environmental Leaders :

http://link.springer.com/openurl?genre=book&isbn=978-4-431- 54339-8

- 4. Lec 31: Environmental Management Systems (EMS) <u>https://youtu.be/BYqLRGawoH0</u>
- 5. ISO 14001:2015 Training Environmental Management https://youtu.be/2f4pBIvXkBs

Course Articulation Matrix														
Course	Program Outcomes (POs)													
(COs)	P01	P02	PO3	P04	PO5	90d	707	PO8	909	P010	P011	P012	PSO1	PSO2
22CIV67.1	-	-	-	-	-	1	3	-	-	-	-	-	-	-
22CIV67.2	-	-	-	-	-	-	3	-	-	-	-	-	-	-
22CIV67.3	-	-	-	-	-	-	3	-	-	-	-	-	-	-
22CIV67.4	-	-	-	-	-	-	3	-	-	-	-	-	-	-
22CIV67.5	-	-	-	-	-	2	3	1	-	-	-	-	-	-
22CIV67.6	-	-	-	-	1	-	-	2	-	-	-	-	-	-

Innovation and Intellectual Property											
Course Code	22IIP68	CIE Marks	100								
Course Type	Prostical	SEE Marks	-								
(Theory/Practical/Integrated)	Practical	Total Marks	100								
Teaching Hours/Week (L:T:P)	0:0:2	Exam Hours	3 Hours								
Total Hours	20 Hrs	Credits	01								

Course Learning Objectives:

- 1. Learn how to use online databases and search tools for conducting patent searches.
- 2. Develop skills in analyzing patent documents and identifying relevant prior art.
- 3. Gain proficiency in evaluating the patentability criteria for engineering inventions.
- 4. Understand the principles of technology gap analysis and patentability search.
- 5. Understand the patent drafting and patent prosecution.

Module-1 Basics of Intellectual Property Rights (4 Hours)

Creativity, Invention, and Innovation – Introduction to Intellectual Property Rights-types and Importance – Overview of Patent Law – Intellectual Property Management and Commercialization – Emerging Issues in Intellectual Property – Case Studies and Practical Examples – Ethical and Social Considerations.

Activity: Trademark Design Challenge – IP Case Study Analysis

Module-2 Patent Landscape Analysis – Technology Gap Analysis (4 Hours)

Overview of Patent Databases and Search Tools – Keyword Searching, Classification Searching, and Citation Searching – Methods for Analyzing Patent Data: Patent Counts, Citation Analysis, and Patent Mapping – Technology Gap Analysis – Patent Portfolios – Portfolio Strength Assessment – Identification of Key Players – Competitive Intelligence and Market Analysis.

Activity: Conduct Patent Landscape Analysis for the Proposed Capstone Project.

Module-3 Patentability Assessment (6 Hours)

Significance of Patentability Assessment – Patentability Criteria: Novelty, Non-obviousness (Inventive Step), and Industrial Applicability/Utility – Prior Art Searching and Analysis (Keyword Searching, Classification Searching, and Citation Searching) – Non-Patent Literature Search and Other sources of Prior Art – Patentability Reports and Assessments – Case Studies and Practical Examples.

Activity: Conduct a Patentability Search for the Proposed Capstone Project.

Module-4 Patent Drafting and Prosecution (6 Hours)

Significance of Patent Drafting and Prosecution – Structure and Components of a Patent Application – Drafting of Patent Specifications, Claims, and Drawings – Overview of Patent Prosecution Process

Activity: Prepare a Patent Draft for the Proposed Capstone Project.

Course Outcomes: At the end of the course, the student will be able to:							
221IP68_1	Demonstrate proficiency in utilizing various online databases and search tools for						
22111 00.1	conducting patent searches.						
22111068 2	Develop advanced skills in analyzing patent documents to identify relevant prior art,						
22111 00.2	including patents, patent applications, and non-patent literature.						
2211069 2	Demonstrate a comprehensive understanding of the patentability criteria, including						
22111 08.5	novelty, non-obviousness, and utility.						
2211D68 /	Explain the principles and methodologies of technology gap analysis and its relevance						
2211P08.4	to patentability searches.						
2211068 5	Gain insight into the patent drafting process, including the structure and components						
22IIP08.5	of patent applications, and patent prosecution.						
221060 c	Apply the acquired knowledge and skills in conducting practical activities, such as						
2211F08.0	conducting patent landscape analysis, patentability searches, and drafting patent						

applications, to solve real-world problems and challenges in the field of intellectual property rights.

SI	Title of the Book	Name of the	Name of the	Edition		
No.	The of the book	Author/s Publisher				
Refe	rence Books/Sources					
1	Intellectual Property-A Primer for Academia	Rupinder Tewari Mamtha	Publication Bureau, Panjab University	2021		
	(For Module 1)	Bhardway	Chandigarh India			
2	Patent Landscape Reports (For Module 2)	WIPO - World Intellectual Property Organization https://www.wipo.int/patentscope/en/programs/patent_la ndscapes				
3	Guidelines for Preparing Patent Landscape Reports (For Module 2)	Anthony Trippe, Patinformatics, LLC	World Intellectual Property Organization (WIPO)	2015		
4	Patent Searching - Tools and Techniques (For Module 3)	David Hunt	John Wiley & Sons Inc	First edition 2007		
5	The Complete Patent Book_ Everything You Need to Obtain Your Patent (For Module 4)	James L. Rogers	Sphinx Publishing	First Edition 2003		

Additional Resources:

- 1. WIPO Patent Drafting Manual Second Edition 2023, <u>https://www.wipo.int/edocs/pubdocs/en/wipo-pub-867-23-en-wipo-patent-drafting-manual.pdf</u>
- 2. Patent Drafting for Beginners <u>https://elearn.nptel.ac.in/shop/nptel/patent-drafting-for-beginners/?v=c86ee0d9d7ed</u>
- 3. The Office of the Controller General of Patents, Designs and Trade Marks, Government of India <u>https://www.ipindia.gov.in/</u>
- 4. Copyright Office, Government of India https://copyright.gov.in/
- 5. United States Patent and Trademark Office https://www.uspto.gov/
- 6. Espacenet patent search https://worldwide.espacenet.com/
- 7. The Lens Free & Open Patent and Scholarly Search https://www.lens.org/
- 8. WIPO PATENTSCOPE https://patentscope.wipo.int/search/en/search.jsf

Course		Program Outcomes (POs)												
Outcomes (Cos)	P01	P02	PO3	P04	PO5	P06	P07	PO8	P09	P010	P011	P012	PS01	PSO2
22IIP68.1	2	-	-	-	3	-	-	-	-	-	-	1	-	-
22IIP68.2	2	-	-	3	-	-	-	-	-	-	-	1	-	-
22IIP68.3	3	-	-	-	-	-	-	-	-	-	1	-	-	-
22IIP68.4	2	-	3	-	-	-	-	-	-	-	-	-	-	-
22IIP68.5	1	3	-	-	-	-	-	-	-	-	1	2	-	-
22IIP68.6	-	-	-	-	2	-	-	-	-	-	I	3	-	-

Course Articulation Matrix

Core Values of the Institution

SERVICE

A Josephite will keep service as the prime goal in everything that is undertaken. Meeting the needs of the stakeholders will be the prime focus of all our endeavors.

EXCELLENCE

A Josephite will not only endeavor to serve, but serve with excellence. Preparing rigorously to excel in whatever we do will be our hallmark.

ACCOUNTABILITY

Every member of the SJEC Family will be guided to deliver on assurances given within the constraints set. A Josephite will always keep budgets and deadlines in mind when delivering a service.

CONTINUOUS ADAPTATION

Every member of the SJEC Family will strive to provide reliable and continuous service by adapting to the changing environment.

COLLABORATION

A Josephite will always seek to collaborate with others and be a team-player in the service of the stakeholders.

Objectives

- Provide Quality Technical Education facilities to every student admitted to the College and facilitate the development of all round personality of the students.
- Provide most competent staff and excellent support facilities like laboratory, library and internet required for good education on a continuous basis.
- Encourage organizing and participation of staff and students in in-house and outside Training programmes, seminars, conferences and workshops on continuous basis.
- Provide incentives and encouragement to motivate staff and students to actively involve in research-innovative projects in collaboration with industry and R&D centres on continuous basis
- Invite more and more number of persons from industry from India and abroad for collaboration and promote Industry-Institute Partnership.
- Encourage consultancy and testing and respond to the needs of the immediate neighbourhood.



St Joseph Engineering College

AN AUTONOMOUS INSTITUTION

Affiliated to VTU, Belagavi | Recognised by AICTE, New Delhi Accredited by NAAC with A+ Grade B.E. (CSE, ECE, EEE, ME, CIV), MBA & MCA Accredited by NBA, New Delhi

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