Shri Shamrao Patil (Yadravkar) Educational & Charitable Trust's
Sharad Institute of Technology College of Engineering
(An Autonomous Institute)
Accredited by NAAC 'A' Grade, ISO 9001:2015Certified
Yadrav (Ichalkaranji)-416121, Dist. – Kolhapur

Teaching and Evaluation Scheme for TY B. Tech.

Department:Artificial Intelligence and Data Science

Semester: VII

Head of Department,
Sharad Institute of Technology
College of Engineering,
Yadrav (Ichalkaranji) Dist. Kolhapur.

Department: Artificial Intelligence and Data Science **Rev:** Course Structure/00/2021-22

Class: Final YearB.Tech **Semester:**VII

Sr. No	Course Code	Course Type	Course	Teaching Scheme				Evaluation Scheme					
				L	T	P	Total Hrs.	CA 1	CA 2	MSE	ESE	Total	Credits
1	AD701	PCC	Deep Learning	3	-	-	3	10	10	30	50	100	3
2	AD702	PEC	Elective-IV	3	-	-	3	10	10	30	50	100	3
3	AD703	PEC	Elective-V	3	-	-	3	10	10	30	50	100	3
4	OEXXX	OEC	Open Elective-III	3	-	-	3	10	10	30	50	100	3
5	AD704	PCC	Advanced Data Visualization	1	-	2	3	15	15	-	20	50	2
6	AD705	PEC	Elective-IV Laboratory	-	-	2	2	15	15	-	20	50	1
7	AD706	PCC	Deep Learning Laboratory	-	-	2	2	15	15	-	20	50	1
8	PRJ06	PROJ	Mega Project Phase-II	-	-	8	8	25	25	-	50	100	4
9	PROJ7	PROJ	Industrial Case Studies (Seminar)	-	-	2	2	15	15		20	50	1
10	MDC03	MC	Values and Ethics	2	-	-	2	-	-	-	-	-	Audit
Total				**13**	**-**	**14**	**27**	**110**	**110**	**120**	**310**	**650**	**21**

Elective-IV:AD702A- Cloud Computing

AD702B- Digital Image Processing

AD702C- Distributed Database

Elective-V:AD703A- File Structures

AD703B- Storage Area Networks

AD703C- Block chain Management

Open Elective-III: Introduction to Data Science

Head of Department,
Artificial Intelligence & Data Science
SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING,
Yadrav (Ichalkaranji) Dist. Kolhapur.

Final Year(ARTIFICIAL INTELLIGENCE AND DATA SCIENCE) Semester VII

AD701	PCC	Deep Learning	3-0-0	3 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture:3hrs/week Tutorial: --	CA 1: 10 Marks CA 2 : 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: -- Machine Learning

Course Outcomes: At the end of the course, students will be able to:

CO1	To enable the students to know deep learning techniques to support real-time applications
CO2	To present the mathematical, statistical and computational challenges of building neural networks
CO3	Understand and implement data visualization using deep learning framework
CO4	Understand the role of training deep neural network.
CO5	Implementation of sequence modeling using RNN and LSTM
CO6	Discussion of role of deep learning in image, Social Network Analysis, speech and NLP

Course Contents:	**Hours**
Unit 1: Introduction to Deep Learning Introduction to AI, ML and Deep Learning, A brief history, Need of Deep Learning, Basics of neural network, anatomy of neural network. Data representation for neural network, Activation function and it's types, Multilayer Perceptron's (MLPs), Difference ML & DL,Applications of Deep Learning, Gradient descent Algorithm,Optimization Algorithm.	6
Unit2: ConvolutionNeural Network Introduction to CNN,Working,CNN Architecture,Building blocks of CNN,Feature Extractor,Operation of Convolution Image,Calculation of CNN Layer,Operation of kernel,stride,padding,ReLu,pooling Layer,Fully connected Layer,Popular CNN Architectures,Object Detection.	6
Unit3: Deep Learning Frameworks Colab,Numpy,Pandas,Sklearn,TensorFlow: Introduction, Downloading and installation of Tensorflow, The computation graph, Modelling cyclic dependencies, Building and running visualization, Computing graph and distribution, Simple math operation and distribution, Tensors, Rank of tensors, Tensor math, Tensorflow example, Keras: Introduction, Models, Layers, Pre processing, Deep Learning case studies, Hyperparameters.	6
Unit4: Training Deep Neural Network Neural Network Parameters, Parameter versus Hyperparameter, Setting Network Parameter, Bias and Variance tradeoff, Batch , Normalization,Vanishing/ExplodingGradient,Optimization	6

Head of Department,
Artificial Intelligence & Data Science
SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING,
Yadrav (Ichalkaranji) Dist. Kolhapur.

Algorithm,Gradient Descent,Mini-batch gradient descent, Regularization strategies.	
Unit5: Recurrent Neural Network &Autoencoders Basics of RNN,Types ofRNN,LSTM,Autoencoders,Architecture,Types of autoencoders,Regularized Autoencoders,Sparse Autoencoders,Denoising Autoencoder,Stochastic Encoders and Decoders,Applications.	**6**
Unit6: Applications of Deep Learning Overview of Deep Learning Applications,Image Classification:Technique,Advantage,Application,Area of Image Classification,Deep Neural Network in Image Classification,Social Network Analysis: SNA Terminologies,Applications,SNA Using Deep Learning,Graph Convolution Approaches,Speech Recognition:Basic Architecture,Traditional ASR,Deep Learning for ASR,Recommender System,Natural Language Processing(NLP)	**6**

Text Book/ Reference Book:

1. Raúl Rojas, Neural Networks: A Systematic Introduction, 1996
2. Christopher Bishop, Pattern Recognition and Machine Learning, 2007.
3. Deep Learning: Amit kumardas,Saptarsi Goswami,Pabitra Mitra,Amlan Chakrabarti,Pearson
4. NPTEL Courses: 1. Prof. Prof. Mitesh M. Khapra, Prof. Sudarshan Iyengar, Dept. of Computer Science and Engineering, IIT Madras & IIT Ropar, NPTEL Course on Deep Learning (Part-I).
5. Michael Nielsen, Neural Networks and Deep Learning, Online book, 2016

SHARAD INSTITUTE OF TECHNOLOGY COLLEGE OF ENGINEERING Dept. of Artificial Intelligence & Data Science

Head of Department,
Artificial Intelligence & Data Science
SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING,
Yadrav (Ichalkaranji) Dist. Kolhapur.

Final Year(ARTIFICIAL INTELLIGENCE AND DATA SCIENCE) Semester VII

AD702A	PEC	Elective-IV- Cloud Computing	3-0-0	3 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: 3hrs/week Tutorial: --	CA 1: 10 Marks CA 2 : 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Mapping of course outcomes with program outcomes

CO1	Understand fundamental concepts of cloud computing
CO2	Understand the architecture of cloud computing
CO3	Make use of Cloud Platforms
CO4	Analyze virtualization technology and install virtualization software
CO5	Analyze cloud computing applications
CO6	Understand Advanced Techniques in Cloud Computing

Course Contents:	**Hours**
Unit1: Introduction to Cloud Computing – Definition of Cloud , Evolution of Cloud Computing, Importance of Cloud Computing, Characteristics, Pros and Cons of Cloud Computing, Migrating into the Cloud, Seven-step model of migration into a Cloud, Trends in Computing. Cloud Service Models: SaaS, PaaS, IaaS, Storage.	**6**
Unit2: Cloud Architecture Cloud Reference Model, Public, Private and Hybrid Clouds, Layered Cloud Architecture Design – NIST Cloud Computing , Logical Architecture, Developing Holistic Cloud Computing Reference Model, Cloud System Architecture, Cloud Deployment Models	**6**
Unit3:Cloud Platforms - Amazon Web Services (AWS): Amazon Web Services and Components, Amazon Simple DB, Elastic Cloud Computing (EC2), Amazon Storage System, Amazon Database services (Dynamo DB). Microsoft Cloud Services: Azure core concepts, SQL Azure, Windows Azure Platform Appliance.	**6**
Unit4: Virtualization in Cloud Computing- Basics of Virtualization, Types of Virtualization, Implementation Levels of Virtualization, Virtualization Structures, Tools and Mechanisms, Virtualization of CPU ,Memory , I/O Devices, Virtualization Support and Disaster Recovery.	**6**

Head of Department,
Artificial Intelligence & Data Science
SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING,
Yadrav (Ichalkaranji) Dist. Kolhapur.

Unit5: Cloud Computing Applications- Healthcare: ECG Analysis in the Cloud, Biology: Protein Structure Prediction, Geosciences: Satellite Image Processing, Business and Consumer Applications: CRM and ERP, Social Networking, Google Cloud Application: Google App Engine. Overview of OpenStack architecture.	**6**
Unit6:Advanced Techniques in Cloud Computing Future Tends in cloud Computing, Mobile Cloud and Automatic Cloud Computing. Introduction to DevOps. IOT and Cloud Convergence: The Cloud and IoT in your Home, The IOT and cloud in your Automobile, PERSONAL: IoT in Healthcare Energy Efficiency in Clouds, Market Based Management of Clouds, Federated Clouds / InterCloud, Third Party Cloud Services.	**6**

Textbooks /Reference:-

1. 1. Mastering Cloud Computing, Buyya R, Vecchiola C, Selvi S T, McGraw Hill Education (India), 2013.
2. Cloud Computing Bible, Barrie Sosinsky ,Wiley Publishing Inc. 2011(Unit,VI)
3. Buyya R, Broberg J, Goscinski A, "Cloud Computing - Principles and Paradigms", Wiley, 2011.

Head of Department,
Artificial Intelligence & Data Science
SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING,
Yadrav (Ichalkaranji) Dist. Kolhapur.

Final Year (ARTIFICIAL INTELLIGENCE AND DATA SCIENCE) Semester VII

AD702B	PEC	Elective-IV- Digital Image Processing	3-0-0	3 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: 3hrs/week Tutorial: --	CA 1: 10 Marks CA 2 : 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Data Structure

Course Outcomes: At the end of the course, students will be able to:

CO1	Describe the fundamental concepts of Digital Image Processing.
CO2	Explain Image Processing Transforms which play significant role in image enhancement, filtering, analysis and compression.
CO3	Demonstrate Image enhancement techniques which play significant role in image enhancement, filtering.
CO4	Examine the need of image compression i.e. the technique of reducing the amount of data required to represent a digital image.
CO5	Summarize the concepts Image segmentation.
CO6	Apply image processing techniques to solve various real time applications.

Course Contents:	**Hours**
Unit1: Digital Image Fundamentals What is Digital Image Processing? The Origins of Digital Image Processing, Examples of Fields that Use Digital Image Processing, Digital image representation, Fundamental Steps in Digital Image Processing, Components of an Image Processing System.	6
Unit2: Image Transforms Elements of visual perception, Image sampling and quantization, Basic relationship between pixels, Discrete Fourier transform, Properties of 2D, DFT,KL-Transforms, Cosine, Introduction to Wavelet Transform.	6
Unit3: Image Enhancement Techniques Spatial Domain Techniques, Point processing, Neighborhood processing, Spatial domain filtering, Image smoothing and Image sharpening using spatial domain filters, Enhancement based on histogram modeling, Frequency domain filtering, Image smoothing and Image sharpening using frequency domain filters.	6
Unit 4: Image Compression Fundamentals, Types of redundancies, Lossy and Lossless compression, Dictionary	6

Head of Department,
Artificial Intelligence & Data Science
SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING,
Yadrav (Ichalkaranji) Dist. Kolhapur.

based coding, Run-length coding, LZW coding, Huffman coding, Arithmetic coding, Image compression model	
Unit 5: Image Segmentation Detection of Discontinuities - Point, Line and Edge detection, finding gradients using masks, Thresholding based image segmentation, global and local thresholding, Region based segmentation.	**6**
Unit 6: Image Processing Applications Biometric Pattern Recognition, Face Recognition. Preprocessing of Signature Patterns, Lung Disease Identification.	**6**

Textbooks /Reference:-

1. R. C. Gonzalez, R. E. Woods," Digital Image Processing"
2. A. K. Jain, "Fundamentals of Digital Image Processing", PH
3. Milan Sonka, Vaclav Hlavac, Boyle, "Digital Image Processing and Computer Vision", Cengage Learning
4. S. Jayaraman, S. Esakkirajan, T. Veerkumar, "Digital Image Processing", Tata McGrawHill
5. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing Using MATLAB", 2nd edition.

Head of Department,
Artificial Intelligence & Data Science
SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING,
Yadrav (Ichalkaranji) Dist. Kolhapur.

Final Year(ARTIFICIAL INTELLIGENCE AND DATA SCIENCE) Semester VII

AD702C	PEC	Elective-IV- Distributed Database	3-0-0	3 Credits

Teaching Scheme:	Examination Scheme:
Lecture: 3hrs/week Tutorial: --	CA 1:10 Marks CA 2:10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Database System

Course Outcomes: At the end of the course, students will be able to:

CO1	Summarize theoretical aspects of distributed database systems
CO2	Construct queries using SQL in database creation and interaction
CO3	Construct algorithms of Transaction and Deadlock management
CO4	Experiment with Distributed and parallel Database
CO5	Analyze Distributed object Database Management Systems and Object Oriented Data Model
CO6	Elaborate current Trends in Distributed Database

Course Contents:	Hours
Unit1:Introduction : Distributed Data Processing, Distributed Database System, Promises of DDBSs, Problem areas. **Distributed DBMS Architecture:**Architectural Models for Distributed DBMS, DDMBS Architecture, **Distributed Database Design:**Alternative Design Strategies, Distribution Design issues, Fragmentation, Allocation.	6
Unit2: Query processing and decomposition: Query processing and decomposition: Query processing objectives, characterization of query processors, layers of query processing, query decomposition, localization of distributed data.Distributed query Optimization: Query optimization, centralized query optimization, distributed query optimization algorithms	6
Unit3: Transaction Management Definition, properties of transaction, types of transactions, distributed concurrency control: serializability, concurrency control mechanisms & algorithms, time - stamped & optimistic concurrency control Algorithms, deadlock Management.	6

Head of Department,
Artificial Intelligence & Data Science
SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING,
Yadrav (Ichalkaranji) Dist. Kolhapur.

Unit4: Distributed DBMS Reliability: Reliability concepts and measures, fault-tolerance in distributed systems, failures in Distributed DBMS, local & distributed reliability protocols, site failures and network partitioning. **Parallel Database Systems:**Parallel database system architectures, parallel data placement, parallel query processing, load balancing, database clusters.	6
Unit5: Distributed object Database Management Systems Fundamental object concepts and models, object distributed design, architectural issues, object management, distributed object storage, object query Processing. **Object Oriented Data Model:**Inheritance, object identity, persistent programming languages, persistence of objects, comparison OODBMS and ORDBMS	6
Unit6:Current Trends in Distributed Database Data Delivery Alternatives Data Warehousing World Wide Web Push-based Technologies Mobile Databases. Real Application Clusters(RAC) Cloud based databases	6

Textbooks /Reference:-

1. M. Tamer OZSU and Patuck Valduriez: Principles of Distributed Database Systems, Pearson Edn. Asia, 2001.
2. Stefano Ceri and Giuseppe Pelagatti: Distributed Databases, McGraw Hill.
3. Hector Garcia-Molina, Jeffrey D. Ullman, Jennifer Widom: "Database Systems: The Complete Book", Second Edition, Pearson International Edition

SHARAD INSTITUTE OF TECHNOLOGY COLLEGE OF ENGINEERING Dept. of Artificial Intelligence & Data Science

Head of Department,
Artificial Intelligence & Data Science
SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING,
Yadrav (Ichalkaranji) Dist. Kolhapur.

Final Year (ARTIFICIAL INTELLIGENCE AND DATA SCIENCE) Semester VII

AD703A	PEC	Elective-V-File Structures	3-0-0	3 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: 3hr/week Tutorial: --	CA 1:10 Marks CA 2:10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Data Structures

Course Outcomes: At the end of the course, students will be able to:

CO1	Explain the fundamentals of file structures and their management.
CO2	Measure the performance of different file structures
CO3	Organize different file structures in the memory.
CO4	Demonstrate Indexed Sequential File Access and Prefix B + Trees
CO5	Demonstrate hashing and indexing techniques.
CO6	Apply concept of Extendible hashing and indexing techniques on files.

Course Contents:	**Hours**
Unit1:Introduction: File Structures: The Heart of the file structure Design, A Short History of File Structure Design, A Conceptual Toolkit; Fundamental File Operations: Physical Files and Logical Files, Opening Files, Closing Files, Reading and Writing, Seeking. Secondary Storage and System Software: Disks, Magnetic Tape, Disk versus Tape; CD-ROM: Introduction, Physical Organization, Strengths and Weaknesses; Storage as Hierarchy, A journey of a Byte, Buffer Management, Input /Output in UNIX. Fundamental File Structure Concepts, Managing Files of Records : Field and Record Organization, Using Classes to Manipulate Buffers, Using Inheritance for Record Buffer Classes, Managing Fixed Length, Fixed Field Buffers, An Object-Oriented Class for Record Files, Record Access, More about Record Structures, Encapsulating Record Operations in a Single Class, File Access and File Organization.	6

Head of Department,
Artificial Intelligence & Data Science
SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING,
Yadrav (Ichalkaranji) Dist. Kolhapur.

Unit2:Organization of Files for Performance, Indexing: Data Compression, Reclaiming Space in files, Internal Sorting and Binary Searching, Keysorting; What is an Index? A Simple Index for Entry-Sequenced File, Using Template Classes in C++ for Object I/O, Object-Oriented support for Indexed, Entry-Sequenced Files of Data Objects, Indexes that are too large to hold in Memory, Indexing to provide access by Multiple keys, Retrieval Using Combinations of Secondary Keys, Improving the Secondary Index structure: Inverted Lists, Selective indexes, Binding.	6
Unit3: Consequential Processing and the Sorting of Large Files: A Model for Implementing Consequential Processes, Application of the Model to a General Ledger Program, Extension of the Model to include Mutiway Merging, A Second Look at Sorting in Memory, Merging as a Way of Sorting Large Files on Disk. Multi-Level Indexing and B-Trees: The invention of B-Tree, Statement of the problem, Indexing with Binary Search Trees; Multi-Level Indexing, B-Trees, Example of Creating a B-Tree, An Object-Oriented Representation of B-Trees, B-Tree Methods; Nomenclature, Formal Definition of B-Tree Properties, Worst-case Search Depth, Deletion, Merging and Redistribution, Redistribution during insertion; B* Trees, Buffering of pages; Virtual B-Trees; Variable-length Records and keys.	6
Unit 4: Indexed Sequential File Access and Prefix B + Trees: Indexed Sequential Access, Maintaining a Sequence Set, Adding a Simple Index to the Sequence Set, The Content of the Index: Separators Instead of Keys, The Simple Prefix B+ Tree and its maintenance, Index Set Block Size, Internal Structure of Index Set Blocks: A Variable-order B- Tree, Loading a Simple Prefix B+ Trees, B-Trees, B+ Trees and Simple Prefix B+ Trees in Perspective.	6
Unit 5:Hashing: Introduction, A Simple Hashing Algorithm, Hashing Functions and Record Distribution, How much Extra Memory should be used?, Collision resolution by progressive overflow, Buckets, Making deletions, Other collision resolution techniques, Patterns of record access.	6
Unit 6: Extendible Hashing: How Extendible Hashing Works, Implementation, Deletion, Extendible Hashing Performance, Alternative Approaches.	6

Textbooks /Reference:-

1. File Structures: An Object-Oriented Approach with C++" by FOLK
2. K.R. Venugopal, K.G. Srinivas, P.M. Krishnaraj: File Structures Using C++, Tata McGraw-Hill
3. Scot Robert Ladd: C++ Components and Algorithms, BPB Publications
4. Raghu Ramakrishan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw Hill.

Head of Department,
Artificial Intelligence & Data Science
SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING,
Yadrav (Ichalkaranji) Dist. Kolhapur.

Final Year (ARTIFICIAL INTELLIGENCE AND DATA SCIENCE) Semester VII

AD703B	PEC	Elective-V-Storage Area Network	3-0-0	3 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: 3hr/week Tutorial: --	CA 1:10 Marks CA 2:10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites:

Course Outcomes: At the end of the course, students will be able to:

CO1	Identifykeychallengesininformationmanagement
CO2	Illustrate Storagesystemarchitectureanddataprotection.
CO3	Explain concepts,componentsandprotocols of Storage area network
CO4	Justify concepts,components,implementationandprotocols of Network-AttachedStorage
CO5	Illustrate ArchitectureofStorageVirtualization.
CO6	Make use ofReplication,ReplicationtechniquesandStorageSecurity

Course Contents:	**Hours**
Unit1:Introductiontoinformationstorage DataCenterInfrastructure,Keychallenges inManaging Information, Information Lifecycle. Components of Storage System Environment,Disk Drive Components,Disk Drive Performance, LogicalComponentsofHost, Applicationrequirements anddiskperformance. Data Protection (RAID):- Implementation of RAID, RAID array components, RAID levels,Comparison,RAID, Impaction diskperformance.	6
Unit2:StorageNetwork Components of SAN, Fibre Channel Protocol Stack- Links, ports and topologies, FC-0: Cables, plugs and Signal Encoding, FC-1: 8b/10b encoding, , FC-2: data Transfer, FC-3: common Services, FC-4 and ULPs, Fibre Channel SAN – point-to- point topology, Fabric topology, Arbitrated loop topology, Hardware components of Fibre channel SAN. IP SAN – iSCSI – components, connectivity, topology, protocol stack, discovery, names, session.	6

Head of Department,
Artificial Intelligence & Data Science
SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING,
Yadrav (Ichalkaranji) Dist. Kolhapur.

Unit3:Network-AttachedStorage Local File Systems, Network File System and File Servers, Benefits of NAS, NAS file I/O, ComponentofNAS,NAS implementations,NASFilesharingProtocols,NASI/Ooperations,FactorsaffectingNASPerformance. CaseStudy:DirectAccessFileSystem, Shared Disk File System	6
Unit4: StorageVirtualization Introduction, Virtualization in the I/O path, Limitations and requirements, Definition of StorageVirtualization, Implementation considerations, Storage Virtualization on block, level, File levelVirtualization, Storage Virtualization on various levels of the storage, network, Symmetric andAsymmetricStorageVirtualization.	6
Unit5: BackupandRecovery Introduction, Information Availability, Cause of Information unavailability, MeasuringinformationAvailability,Backup Purpose, Considerations, BackupGranularity, Recovery Considerations, Backup Methods, Backup Process, Backup and RestoreOperations, BackupTopology, BackupinNASenvironment,BackupTechnologies.	6
Unit6:Replication andStorageSecurity LocalReplication,UsesofLocalReplicas,DataConsistency,LocalReplicationTechnologies,Restoreand Restart Considerations.Storage Security: Storage Security Framework, Risk Triad, Storage Security Domains, SecurityImplementationsin StorageNetworking.	6

Textbooks /Reference:-

1. AnInformationStorageandManagementbyG.Somasudaram–EMCEducationServices(WileyIndiaEdition).
2. Storage Networks Explained byUlf Troppen, Rainer Erkens, Wolfgang Müller (WileyIndia Edition).

Head of Department,
Artificial Intelligence & Data Science
SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING,
Yadrav (Ichalkaranji) Dist. Kolhapur.

Final Year (ARTIFICIAL INTELLIGENCE AND DATA SCIENCE) Semester VII

AD703C	PEC	Elective-V- Block chain Management	3-0-0	3 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: 3hr/week Tutorial: --	CA 1:10 Marks CA 2:10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Cryptography, Data Structure

Course Outcomes: At the end of the course, students will be able to:

CO1	Demonstrate block chain
CO2	Make use of Bit coinBlock chain.
CO3	Explain Ethereum Block chain
CO4	Explain Enterprises Block chain
CO5	Develop Ethereum Smart Contracts
CO6	Summarize Hyper ledger Fabric Chain code

Course Contents:	**Hours**
Unit1:Introduction to Block chain Challenges Faced by Modern Businesses ,What is Blockchain?, Building Blocks of Blockchain, Types of Blockchain , Knowledge Check, Introduction to Blockchain Pillars , Cryptography , Consensus, Distributed Ledger , Assisted Practice: Send a Message Using Symmetric Cryptography, Assisted Practice: Sign a Message Using Asymmetric Cryptography.	**6**
Unit2:Bitcoin Blockchain Introduction to Bitcoin, Bitcoin Wallets, Bitcoin Scripts, Bitcoin Attacks, Bitcoin Network, Bitcoin Mining, Assisted practice: Install a Software Wallet (combine software and web wallet) Assisted practice: Generate a Paper Wallet Bitcoin Block Bitcoin Transaction.	**6**
Unit4: Enterprises Blockchain Enterprise Blockchain ,Hyperledger ,Hyperledger Sawtooth ,Hyperledger Iroha, Hyperledger Indy, Hyperledger Burrows, Hyperledger Fabri,c Hyperledger Fabric Transaction Fabric Network Fabric Network Types Fabric Explorer Node Js R3 Corda Corda Network.	**6**

Head of Department,
Artificial Intelligence & Data Science
SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING,
Yadrav (Ichalkaranji) Dist. Kolhapur.

Unit5: Ethereum Smart Contracts Smart Contract Lifecycle ,Solidity, Solidity Variables, Solidity Compilation and Deployment Solidity Functions Truffle Security Consideration ,Web3, Assisted Practice: Generate the ABI and Byte code of a Smart Contract	**6**
Unit6:Hyper ledger Fabric Chaincode Chaincode, Gradle, Chaincode Java API, Chaincode Development, Chaincode Package-Install, Approve. **Hyper ledger Fabric SDK**-Fabric SDK Introduction, Node SDK, **Multichain**-Introduction to Multichain, Multichain Installation, Create a Multichain Instance, Multichain Assets, Multichain Streams, Multichain Consensus, Multichain API.	**6**

Textbooks /Reference:-

1. Draft version of "S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, 'Blockchain Technology: Cryptocurrency and Applications', Oxford University Press, 2019.
2. Josh Thompson, 'Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming', Create Space Independent Publishing Platform, 2017.
3. Melanie Swan, "Blockchain: Blueprint for a New Economy", O'Reilly, 2015.
4. Daniel Drescher, "Blockchain Basics", Apress; 1st Edition, 2017.
5. Anshul Kaushik, "Blockchain and Crypto Currencies", Khanna Publishing House, Delhi.
6. Salman Baset, Luc Desrosiers, Nitin Gaur, Petr Novotny, Anthony O'Dowd, Venkatraman Ramakrishna, "Hands-On Block Chain with Hyperledger: Building Decentralized Applications with Hyperledger Fabric and Composer", Import, 2018.
7. Ritesh Modi, "Solidity Programming Essentials: A Beginner's Guide to Build Smart Contracts for Ethereum and Blockchain", Packt Publishing

Head of Department,
Artificial Intelligence & Data Science
SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING,
Yadrav (Ichalkaranji) Dist. Kolhapur.

Final Year (ARTIFICIAL INTELLIGENCE AND DATA SCIENCE) Semester VII

OEC03	OEC	Open Elective-III- Introduction to Data Science	3-0-0	3 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: 3hr/week Tutorial: --	CA 1:10 Marks CA 2:10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Knowledge of Statistics, Data Structures and Algorithms.

Course Outcomes: At the end of the course, students will be able to:

CO1	Understand Basic concept of Data Science.
CO2	Summarize the Data Science process.
CO3	Utilize the Data Analysis Tools for Data Science and Analytics.
CO4	Make use of NumPy package to build a solution of a given problem.
CO5	Make use of Pandas package for data manipulation.
CO6	Analyze data using visualization with Matplotlib.

Course Contents:	**Hours**
Unit 1: Introduction What Is Data Science, Data Science Brief History, Difference between Data Science and Data Analytics, Knowledge and Skills for Data Science Professionals, Some Technologies used in Data Science, Benefits and uses of data science, Facets of data.	6
Unit 2: Data Science Process Overview, defining research goals and creating a project charter, retrieving data, Cleansing, integrating, and transforming data, Exploratory data analysis, Build the models, presenting findings and building applications on top of them.	6
Unit 3: Data Analysis Tools Data Analysis Using Excel: Introduction, Getting Started with Excel, Format Data as a Table, Filter and Sort, Perform Simple Calculations, Data Manipulation Sorting and Filtering Data, Highlighting Data, Aggregating Data: Count, Total Sum Basic Calculation using Excel, Analysing Data using Pivot Table/Pivot Chart, Descriptive Statistics using Excel, Visualizing Data using Excel Charts and Graphs, Visualizing Categorical Data: Bar Charts, Pie Charts	6
Unit 4: Introduction to NumPy Creating Arrays from Scratch, NumPy Standard Data Types, The Basics of NumPy Arrays, Array Indexing, slicing, reshaping, Concatenation, splitting, Computation on	6

Head of Department,
Artificial Intelligence & Data Science
SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING,
Yadrav (Ichalkaranji) Dist. Kolhapur.

NumPy Arrays: Universal Functions, Aggregations: Min, Max, Comparison operator, Boolean arrays.	
Unit 5: Introduction to Pandas Introducing Pandas Objects, Data Indexing and Selection, Operating on Data in Pandas, Handling Missing Data, Hierarchical Indexing. Combining Datasets: Concat and Append, Combining Datasets: Merge and Join, Aggregation and Grouping, Pivot Tables.	**6**
Unit 6: Visualization with Matplotlib General Matplotlib Tips, Simple Line Plots, Simple Scatter Plots, Visualizing Errors, Density and Contour Plots, Histograms, Binnings, and Density.	**6**

Textbooks /Reference:-

1. Davy Cielen, Arno D. B. Meysman, Mohamed Ali, "Introducing Data Science",Manning Publications.
2. DR.AmarSahay, "Essentials of Data Science and Analytics", O'REILLY Publication.
3. Paul McFedries, "Excel Data Analysis for Dummies", © 2019 by John Wiley & Sons, Inc.
4. Jake VanderPlas, "Python Data Science Handbook: Essential Tools for Working with Data", O'REILLY Publication

Head of Department,
Artificial Intelligence & Data Science
SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING,
Yadrav (Ichalkaranji) Dist. Kolhapur.

Final Year (ARTIFICIAL INTELLIGENCE AND DATA SCIENCE) Semester VII

AD704	PCC	Advanced Data Visualization	1-0-2	2 Credits

Practical Scheme:	**Examination Scheme:**
Lecture: 1hr/week Tutorial: -- Practical:2hr/week	CA 1:15 Marks CA 2:15 Marks Mid Semester Exam: --- End Semester Exam: 20 Marks

Pre-Requisites: Data science & Visualization

Course Outcomes: At the end of the course, students will be able to:

CO1	Construct different types of charts based on data.
CO2	Make use of different strategies for exploratory data analysis
CO3	Construct histograms, tree maps for visualization of complicated data.
CO4	Demonstrate the story of the data using various options available in the tool.

Course Contents:	**Hours**
Unit1: Fundamentals of visualization with tableau, Data visualization, and its importance, getting to know tableau for data visualization, Line chart, bar chart.	**2**
Unit2: Introduction to Charting, Tableau Charts, Colors, Shapes, and Sizes, Pie Charts, Maps, Scatter Plots, Gantt Charts, Bubble Charts	**2**
Unit3: Cognitive vs Perceptual Design Distinction, Explanatory Analysis, Static Versus Interactive Visualizations, Multiple, Connected View, Language, Labeling, and Scales, Visual Lies, and Cognitive Bias	**2**
Unit4: Histograms, Bullet Charts, Heat Maps and Highlight Tables, Charting, Tree maps	**2**
Unit5: Box-and-Whisker Plots, Dates, Table calculation, Mapping	**2**
Unit6: Hierarchies, Actions, Filters, and Parameters, Tell your story of data	**2**

Textbooks /Reference:-

1. Tableau For Dummies" by Molly Monsey and Paul Sochan
2. Tableau Public for Data Visualization" by Ryan Sleeper

Head of Department,
Artificial Intelligence & Data Science
SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING,
Yadrav (Ichalkaranji) Dist. Kolhapur.

Practical List

1. Connecting to data sources: Tableau allows you to connect to various data sources such as Excel, CSV, databases (SQL Server, MySQL, Oracle, etc.), and cloud platforms (Google Analytics, Salesforce, etc.)
2. Building visualizations: Tableau provides a wide range of visualization options, including bar maps, treemaps, and more. You can create interactive and dynamic visualizations using drag-an
3. Creating dashboards: Dashboards are a collection of multiple visualizations that allow you to present and analyze data in a consolidated manner. You can combine various charts, tables, filters, and parameters to create interactive and informative dashboards
4. Adding calculations and fields: Tableau enables you to create calculated fields using mathematical operations, aggregations, logical expressions, and functions. You can perform calculations on existing fields or create new fields based on specific criteria.
5. Applying filters and parameters: Filters allow you to limit the data displayed in your visualizations based on specific conditions. Parameters provide a way to dynamically change values in calculations, filters, and other elements, enabling user interactivity
6. Implementing data blending and data blending: Tableau allows you to combine data from mu blending the data or joining it. Data blending helps when direct joins are not possible or when of granularity
7. Utilizing table calculations: Tableau provides powerful table calculations that enable you to perform complex calculations on data displayed in tables and charts. Examples include running totals, percent of total, moving averages, and more.
8. Creating parameters for dynamic analysis: Parameters allow users to input values that affect cal visualization. You can use parameters to enable dynamic what-if analysis or create interactive f

Head of Department,
Artificial Intelligence & Data Science
SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING,
Yadrav (Ichalkaranji) Dist. Kolhapur.

Final Year (ARTIFICIAL INTELLIGENCE AND DATA SCIENCE) Semester VII

AD705A	PEC	Elective-IV Laboratory-Cloud Computing	0-0-2	1 Credits

Practical Scheme:	**Examination Scheme:**
Lecture: --- Tutorial: -- Practical:2hr/week	CA 1:15 Marks CA 2:15 Marks Mid Semester Exam: --- End Semester Exam: 20 Marks

Practical List

1. Use Goggle Doc to make spreadsheet and notes
2. Install/Configure cloud using JustCloud
3. Use Cloud9 to demonstrate use of different language
4. Create/Delete Virtual Machines using VMware (Private Cloud)
5. Implement Storage Service on Cloud using OpenStack
6. Use OpenStack for File Management
7. Create and Host Simple Web Application on Microsoft Azure/Google cloud/Any cloud platform
8. ImplementIdentityManagementandAccessManagementusing OpenStack
9. Design a small application based on IoT using Arduino
10. Design a small application based on IoT using Raspberry pi

Head of Department,
Artificial Intelligence & Data Science
SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING,
Yadrav (Ichalkaranji) Dist. Kolhapur.

Final Year (ARTIFICIAL INTELLIGENCE AND DATA SCIENCE) Semester VII

AD705B	PEC	Elective-IV Laboratory-Digital Image Processing	0-0-2	1 Credits

Practical Scheme:	**Examination Scheme:**
Lecture: --- Tutorial: -- Practical:2hr/week	CA 1:15 Marks CA 2:15 Marks Mid Semester Exam: --- End Semester Exam: 20 Marks

Practical List

1.Study of Matlab environment and implementation of matlab commands, functions and programming constructs
2. Point processing in spatial domain a. Negation of an image b. Thresholding of an image c. Contrast Stretching of an image
3. Program to implement Bit Plane Slicing
4. Program for plotting a Histogram of an image
5. Program to implement Histogram Equalization
6. To write a Program for Histogram Specification
7. Zooming an image by interpolation and replication
8. Filtering in spatial domain a. Low Pass Filtering b. High Pass Filtering c. Median filtering
9. Edge Detection using derivative filter mask a. Prewitt b. Sobel c. Laplacian
10. Data compression using Huffman coding

Head of Department,
Artificial Intelligence & Data Science
SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING,
Yadrav (Ichalkaranji) Dist. Kolhapur.

11. Filtering in frequency domain

    a. Low pass filter

    b. High pass filter

Head of Department,
Artificial Intelligence & Data Science
SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING,
Yadrav (Ichalkaranji) Dist. Kolhapur.

Final Year (ARTIFICIAL INTELLIGENCE AND DATA SCIENCE) Semester VII

AD705C	PEC	Elective-IV Laboratory-Distributed Database	0-0-2	1 Credits

Practical Scheme:	**Examination Scheme:**
Lecture: --- Tutorial: -- Practical:2hr/week	CA 1:15 Marks CA 2:15 Marks Mid Semester Exam: --- End Semester Exam: 20 Marks

Practical List

1. CreatetwodatabaseseitheronsingleDBMSandDesignDatabasetofragmentandsharethefragments frombothdatabaseandwritesinglequeryfor creatingview.
2. Create two databases on two different computer systems and create database view togenerate singleDDB.
3. Createvariousviewsusinganyoneofexamplesofdatabase andDesignvariousconstraints
4. Writeand ImplementalgorithmforqueryprocessingusinganyofExampleineitherC/C++/Java/.NET
5. Using any of example, write various Transaction statement and show the informationaboutconcurrencycontrol[i.e.variouslock'sfromdictionary]byexecutingmultipleupdateandqueries.
6. UsingTransaction/commit rollback,ShowthetransactionACIDproperties.
7. Distinguish Distributed and parallel Database with different criteria
8. Study on OODBMS and ORDBMS
9. Create connection of database that can be connected to a mobile computing device over a mobile network (or wireless network).
10. Case study on Real Application Clusters(RAC) Cloud based databases

Head of Department,
Artificial Intelligence & Data Science
SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING,
Yadrav (Ichalkaranji) Dist. Kolhapur.

Final Year (ARTIFICIAL INTELLIGENCE AND DATA SCIENCE) Semester VII

AD706	PROJ	Deep Learning Laboratory	0-0-2	1 Credits

Practical Scheme:	**Examination Scheme:**
Lecture: --- Tutorial: -- Practical:2hr/week	CA 1:15 Marks CA 2:15 Marks Mid Semester Exam: --- End Semester Exam: 20 Marks

Practical List

1. Installing of Anaconda or Miniconda and working with Tensorflow and Keras
2. Developing simple perceptron (single layer neural network)
3. Developing simple multilayer neural network for different tasks
4. Designing and developing basic CNN for given task
5. Use transfer learning in CNN
6. Designing and developing simple RNN for given task
7. Designing and developing RNN with LSTM for given task
8. Designing and developing RNN with GRU for given task
9. Designing and developing model for Text or audio generation using LSTM/CNN
10. Designing and developing model for generating images

Head of Department,
Artificial Intelligence & Data Science
SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING,
Yadrav (Ichalkaranji) Dist. Kolhapur.

Final Year (ARTIFICIAL INTELLIGENCE AND DATA SCIENCE) Semester VII

PRJ06	PROJ	Mega Project Phase-II	0-0-8	4Credits

Practical Scheme:	**Examination Scheme:**
Lecture: --- Tutorial: -- Practical:8 hr./week	CA 1:25 Marks CA 2:25 Marks Mid Semester Exam: --- End Semester Exam: 50 Marks

Pre-Requisites: Basic Knowledge of Core Computer science Engineering Subjects

Course Outcomes: At the end of the course, students will be able to:

CO1	Identify real life problem and feasibility of solution to the problem
CO2	Analyze and optimize solutions to real life problems with individual and team work through modern tool usage
CO3	Improve professional ethics and communication skill and engage with environment sustainability to build lifelong learning attitude

Team Work

1. At the end of semester student have to submit project phase-2 report for POE.

Head of Department,
Artificial Intelligence & Data Science
SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING,
Yadrav (Ichalkaranji) Dist. Kolhapur.

Final Year (ARTIFICIAL INTELLIGENCE AND DATA SCIENCE) Semester VII

PRJ07	PROJ	Industrial Case Studies (Seminar)	0-0-2	1 Credits

Practical Scheme:	**Examination Scheme:**
Lecture: --- Tutorial: -- Practical:2hr./week	CA 1:15 Marks CA 2:15 Marks Mid Semester Exam: --- End Semester Exam: 20 Marks

Pre-Requisites: Communication skill, Programming Languages

Course Outcomes: At the end of the course, students will be able to:

CO1	Identify technical and practical issues related to the area of course specialization.
CO2	Plan a well-organized case studies report employing elements of technical writing and critical thinking.
CO3	Demonstrate the ability to describe, interpret and analyze technical issues and develop competence in presenting.

Course Contents:

The Artificial Intelligence and Data Science group believes that through industrial case studies, students will improve their ability to learn and retain concepts in their courses, on work terms and in their professional lives. One of the best means to create case studies is by converting them from student-generated work reports. As a result, it is in our best interest to ensure that work reports submitted to our group contain an adequate design process and topics that align with topics that professors have suggested would benefit from case studies. We also believe that students will benefit by having suggestions for work term report topics. The student has to select a Seminar topic/Case Studies work based on topic of interest. Periodically the implementation will be evaluated by the project guide. The work starts after sixth semester and evaluated in the seventh semester. The end of each semester student will be evaluated by departmental committee/faculty assigned by HOD. Students can choose any relevant topic which is relevant to industry

Head of Department,
Artificial Intelligence & Data Science
SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING,
Yadrav (Ichalkaranji) Dist. Kolhapur.

Final Year (ARTIFICIAL INTELLIGENCE AND DATA SCIENCE) Semester VII

Ad707		Values and Ethics	2-0-0	Audit

Practical Scheme:	**Examination Scheme:**
Lecture: 2 hr./week Tutorial: -- Practical:----	CA 1:---- CA 2:---- Mid Semester Exam: --- End Semester Exam: ----

Pre-Requisites:

Course Outcomes: At the end of the course, students will be able to:

CO1	Relate the Ethics & Human interface
CO2	Improve Attitude, Morals, Aptitude, Integrity towards Society
CO3	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.
CO4	Explain the significance of value inputs in a classroom and start applying them in their life and profession
CO5	Develop Publication ethics
CO6	Develop Business ethics in professional careers

Course Contents:	**Hours**
Unit 1 Ethics and Human Interface : Ethics and Human Interface, Essence, determinants and consequences of Ethics in human actions; Dimensions of ethics; ethics in private and public relationships Human Values – lessons from the lives and teachings of great leaders, reformers and administrators, Role of family, society in inculcating values, role of educational institutions in inculcating values	**2**
Unit 2: Attitude, Morals, Aptitude, Integrity towards Society Attitude: content, structure, function, Attitude and its influence and relation with thought and behavior, Aptitude and foundational values towards society , integrity, impartiality and non-partisanship, objectivity, dedication towards society, empathy, tolerance and compassion intelligence-concepts, and their utilities and application	**2**
Unit 3:Understanding Harmony in the Human Being - Harmony in Myself Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body', Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Swasthya, Understanding harmony in the Family	**2**

Head of Department,
Artificial Intelligence & Data Science
SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING,
Yadrav (Ichalkaranji) Dist. Kolhapur.

Unit 4: Value Education: Need, Guidelines, content and process for Value Education, Self Exploration–; Natural Acceptance and Experiential Validation, Continuous Happiness and Prosperity, Right understanding, Relationship and Physical Facilities, Understanding Happiness and Prosperity correctly, Method to fulfill the above human aspirations: understanding and living in harmony at various levels	**2**
Unit 5: Publication Ethics Publication Ethics: Introduction, Scope & importance, Best practices/standards initiatives & Guidelines: COPE, WAME,etc., Conflict of Interest, Publication Misconduct: definition, concept, problems that lead to unethical behavior & Vice versa, Violation of Publication Ethics, Authorship &Contributor ship, Identification of Publication misconduct, complaints & appeals, Predatory publishers & Journals	**2**
Unit 6: Business Ethics Ethics - Meaning, Importance, & Types of Ethics, Nature and Relevance to Business ethics, Values and Attitudes of Professional Engineers, Seven Principles of Public Life, Ethics in Business: Features, Principles, Need & Importance, Issues in Business ethics, Improving ethical behavior in Business	**2**

Text Books/ Reference Books:

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.
2. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
3. Neeraj Kumar, "Lexicon for Ethics, Integrity & Aptitude", Chronicle Publication, 2016.
4. Santosh Ajmera, Nand Kishor Reddi, "Ethics - Integrity and Aptitude", Tata Mc Graw Hill Publication, 2014.
5. M. Karthikeyan"Ethics, Integrity and Aptitude", Tata Mc Graw Hill Publication, 2015.
6. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA.
7. A N Tripathy, 2003, Human Values, New Age International Publishers.
8. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists &Engineers , Oxford University Press.
9. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
10. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.
11. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.

SHARAD INSTITUTE OF TECHNOLOGY COLLEGE OF ENGINEERING Dept. of Artificial Intelligence & Data Science

Head of Department,
Artificial Intelligence & Data Science
SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING,
Yadrav (Ichalkaranji) Dist. Kolhapur.