BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE:ODALAREVU
(AUTONOMOUS)

B. Tech CSE (AI&ML) (BR23) COURSE STRUCTURE & SYLLABUS

(Applicable from the academic year 2023-24 and onwards)

B.Tech. – III Year II Semester

S.No.	Course code	Category	Title	L	T	P	Credits
1	23AM6T04	PCC	Natural Language Processing	3	0	0	3
2	23AM6T03	PCC	Deep Learning	3	0	0	3
3	23AD6T06	PCC	Data Visualization	3	0	0	3
4	23CS6D05 23AD6D05 23CS6D06 23AD6D06	PE-II	1. Software Testing Methodology 2. Cryptography & Network Security 3. DevOps 4. Recommender Systems 5. Any of the 12-Week SWAYAM /NPTEL Course suggested by the BoS	3	0	0	3
5	23CS6D08 23CS6D09 23AD6D08 23AD6D07	PE-III	1. Software Project Management 2. Mobile Adhoc Networks 3. Computer Vision 4. NoSQL Databases 5. Any of the 12-Week SWAYAM /NPTEL Course suggested by the BoS	3	0	0	3
6		OE - II		3	0	0	3
7	23AM6L02	PCC	Deep Learning Lab	0	0	3	1.5
8	23AM6L04	PCC	Data Visualization Lab	0	0	3	1.5
9	23HM6S02	SEC	Soft skills	0	1	2	2
10	23AC6T03	Audit Course	Technical Paper Writing & IPR	2	0	0	-
			Total	20	1	8	23

Mandatory Industry Internship / Mini Project of 08 weeks duration during summer vacation.
*Under Industry Internship interested students can purse SWAYAM Plus courses viz, Hands on Masterclass on Data Analytics OR Artificial Intelligence for Real –World Applications.

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University Nominee	Subject Expert	Subject Expert	Industrial Expert	Alumni Expert	Chairperson-BOS.

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III Year- I Semester	Code:23AM5T04	L	T	P	C
		3	0	0	3

NATURAL LANGUAGE PROCESSING

Course Objectives:

The main objectives of the course is to

- Introduce foundational concepts of Natural Language Processing including language models, morphology, and text preprocessing techniques.
- Understand word-level NLP techniques including N-gram models, PoS tagging methods, and probabilistic models.
- Introduce syntactic analysis using grammar formalisms, parsing techniques, and probabilistic grammar models.
- Understand discourse analysis techniques and utilize key lexical resources for NLP tasks.

Course Outcomes: Students are able

CO Number	Course Outcome	Blooms Level
CO1	Apply NLP basics like language models, tokenization, and FSA for text processing tasks	BL3
CO2	Apply word-level NLP techniques including N-grams, PoS tagging, and probabilistic models	BL2
CO3	Apply syntactic parsing techniques using context-free and probabilistic grammars for sentence analysis	BL3
CO4	Apply semantic analysis techniques and word sense disambiguation using logical and lexical methods	BL3
CO5	Discourse analysis techniques and utilize lexical resources for coherent language understanding	BL4

UNITI **15Hrs**

INTRODUCTION: Origins and challenges of NLP – Language Modelling: Grammar-based LM, Statistical LM – Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance.

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UNITII **15Hrs** **WORD LEVEL ANALYSIS:** Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part- of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models
UNITIII **12Hrs** **SYNTACTIC ANALYSIS:** Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing–ShallowparsingProbabilisticCFG,ProbabilisticCYK,ProbabilisticLexicalizedCFGs–Feature structures, Unification of feature structures
UNITIV **15Hrs** **SEMANTICS AND PRAGMATICS:** Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions–Word Sense Disambiguation, WSD using Supervised, Dictionary& Thesaurus, Boot strapping methods – Word Similarity using Thesaurus and Distributional methods.
UNITV **12Hrs** **DISCOURSE ANALYSIS AND LEXICAL RESOURCES:** Discourse segmentation, Coherence–Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution–Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, Prop Bank, Frame Net, Brown Corpus, British National Corpus (BNC).
Text Books: 1. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, 2nd Edition, Daniel Jurafsky, James H. Martin -Pearson Publication,2014. 2. Natural Language Processing with Python, First Edition, Steven Bird, Ewan Klein and Edward Loper, OReilly Media,2009.
Reference Books: 1. Language Processing with Java and Ling Pipe Cook book, 1st Edition, BreckBaldwin, Atlantic Publisher, 2015. 2. Natural Language Processing with Java, 2nd Edition, Richard MReese, OReilly Media,2015. 3. Hand book of Natural Language Processing, Second, NitinIndurkhya and FredJ.Damerau, Chapman and Hall/CRC Press, 2010.Edition 4. Natural Language Processing and Information Retrieval, 3rd Edition, TanveerSiddiqui, U.S. Tiwary, Oxford University Press,2008.

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III Year -I Semester	Code:23AM5T03	L	T	P	C
		3	0	0	3

Deep Learning

CourseObjectives:

The main objective of the course is to

- To introduce foundational concepts of neural computation through perceptron models and learning algorithms.
- To impart knowledge on training deep neural net works using gradient-based methods, regularization, and auto encoders.
- To explore advanced optimization and regularization techniques for efficient neural net work training.
- To develop understanding of RNNs, CNNs, and generative models for complex learning tasks.
- To introduce recent deep learning models like VAEs and Transformers for applications in vision, NLP, and speech.

Course Outcomes: Students are able

CO Number	Course Outcome	Blooms Level
CO1	Analyze perceptron learning and neuron models with concepts of linear separability and convergence.	BL2
CO2	Apply back propagation and regularization in training deep neural networks using empirical risk minimization.	BL3
CO3	Apply advanced optimization and regularization techniques to improve neural network training.	BL3
CO4	Analyze advanced RNNs, CNNs, and generative models like RBMs and Deep Boltzmann Machines.	BL4
CO5	Evaluatedeepgenerativemodelsandtransformerarchitecturesforapplicationsin vision, NLP, and speech.	BL5

UNITI **15Hrs**

Basics- Biological Neuron, Idea of computational units, McCulloch–Pitts unit and Thresholding logic, Linear Perceptron, Perceptron Learning Algorithm, Linear separability, Convergence theorem for Perceptron Learning Algorithm.

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UNIT II	**15Hrs**
Feed forward Networks –Multilayer Perceptron, Gradient Descent, Back propagation, Empirical Risk Minimization, regularization, autoencoders. Deep Neural Networks : Difficulty of training deep neural networks, Greedy layer wise training.	
UNIT III	**12Hrs**
Better Training of Neural Networks-Newer optimization methods for neural networks (Adagrad, ad delta, rms prop, a dam, NAG), second order methods for training, Saddle point problem in neural networks, Regularization methods (dropout, drop connect, batch normalization).	
UNITIV	**15Hrs**
Recurrent Neural Networks – Back propagation through time, Long Short-Term Memory, Gated Recurrent Units, Bidirectional LSTMs, Bidirectional RNNs. Convolutional Neural Networks: LeNet, AlexNet. Generative models: Restrictive Boltzmann Machines (RBMs),Introduction to MCMC and Gibbs Sampling, gradient computations in RBMs ,Deep Boltzmann Machines	
UNITV	**12Hrs**
Recenttrends -Variational Auto encoders, Transformers, GPT Applications: Vision, NLP ,Speech	
Text Books: 1.Deep Learning, Ian Good fellow and YoshuaBengio and AaronCourville, MITPress,2016	
Reference Books: 1. 1. Neural Networks: A Systematic Introduction, RaúlRojas,1996 2. Pattern Recognition and MachineLearning,ChristopherBishop,2007 3. Deep Learning with Python, FrançoisChollet,Manning Publications,2017	

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ODALAREVU – 533 210, Andhra Pradesh, India
Autonomous

III Year - II Semester	Code: 23AD6T06	L	T	P	C
		3	0	0	3

DATA VISUALIZATION
Common to CSE(AI&DS)/AIML/CSE(AI&ML)

Course Objectives:
The main objectives of the course is to

- Understand the fundamentals of data visualization, its history, principles, and the role of visual perception.
- Learn to create effective visual representations using visual mapping, analytics, and application design principles.
- Understand visualization system types and techniques for representing one-, two-, multi-dimensional, and text data.
- Explore techniques for visualizing hierarchical, relational, and clustered data using metaphorical approaches.
- Understand advanced visualization techniques for spatial, scientific, and collaborative data, including evaluation and recent trends.

Course Outcomes: Students are able

CO Number	Course Outcome	Blooms Level
CO 1	Analyze principles of data visualization, perception, and representation to interpret complex information	BL3
CO 2	Visual mapping techniques and design effective visualization applications using reference models.	BL4
CO 3	Visualization systems and techniques for representing multi-dimensional and textual data.	BL4
CO 4	Analyze techniques for visualizing groups, trees, graphs, clusters, networks, and metaphorical data.	BL3
CO 5	Advanced visualization techniques for spatial data, simulations, and recent perceptual trends	BL4

UNIT I **15Hrs**

Introduction: What Is Visualization?, History of Visualization, Relationship between Visualization andOther Fields The Visualization Process, Introduction of visual perception, visual representation of data, Gestalt principles, information overloads.

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UNIT II	**15Hrs**
Creating visual representations, visualization reference model, visual mapping, visual analytics, Design of visualization applications	
UNIT III	**12Hrs**
Classification of visualization systems, Interaction and visualization techniques misleading, Visualization of one, two and multi-dimensional data, text and text documents.	
UNIT V	**12Hrs**
Visualization of volumetric data, vector fields, processes and simulations, Visualization of maps, geographic information, GIS systems, collaborative visualizations, Evaluating visualizations **Recent trends** in various perception techniques, various visualization techniques, data structures used in data visualization.	
Text Books: 1. 1. WARD, GRINSTEIN, KEIM.Interactive Data Visualization: Foundations, Techniques, and Applications. Natick : A K Peters, Ltd. 2. E. Tufte, The Visual Display of Quantitative Information, Graphics Press.	
Online Learning Resources: 1. 1. https://kdd.cs.ksu.edu/Courses/CIS536/Lectures/Slides/Lecture-34-Main_6up.pdf	

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III Year - II Semester	Code: 23CS6D05	L	T	P	C
		3	0	0	3

SOFTWARE TESTING METHODOLOGIES
(Common to CSE,CSE-(AI&DS),AIML,CSE(AI&ML),IT)

Course Objectives:

The main objectives of the course is to

- To provide knowledge of the concepts in software testing such as testing process, criteria, strategies, and methodologies.

To develop skills in software test automation and management using the latest tools

Course Outcomes: Students are able

CO Number	Course Outcome	Blooms Level
CO 1	Define key concepts of software testing including purpose, dichotomies, testing models, and types of bugs.	BL1
CO 2	Describe the basics of data flow testing and apply strategies to identify anomalies in variable usage.	BL3
CO 3	Illustrate path products, path expressions, and regular expressions for flow anomaly detection in software.	BL2
CO 4	Assess software testability using state models and transitions.	BL5
CO 5	Demonstrate practical knowledge in automated testing tools (e.g., JMeter, Selenium, SoapUI, Catalon) to design and execute test cases	BL3

UNIT I

Introduction: Purpose of testing, Dichotomies, model for testing, consequences of bugs, taxonomy of bugs Flow graphs and Path testing: Basics concepts of path testing, predicates, path predicates and achievable paths, path sensitizing, path instrumentation, application of path testing.

UNIT II

Transaction Flow Testing: transaction flows, transaction flow testing techniques.

Data Flow testing: Basics of data flow testing, strategies in data flow testing, application of data flow testing.

Domain Testing: domains and paths, Nice & ugly domains, domain testing, domains and interfaces testing, domain and interface testing, domains and testability.

UNIT III

Paths, Path products and Regular expressions: path products & path expression, reduction procedure, applications, regular expressions & flow anomaly detection.

Logic Based Testing: overview, decision tables, path expressions, kv charts, specifications.

UNIT IV

State, State Graphs and Transition testing: state graphs, good & bad state graphs, state testing, Testability tips.

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UNIT V Graph Matrices and Application: Motivational overview, matrix of graph, relations, power of a matrix, node reduction algorithm, building tools. (Student should be given an exposure to a tool like Jmeter/selenium/soapUI/Catalon).
Text Books: 1. Software Testing techniques - Baris Beizer, Dreamtech, second edition. 2. Software Testing Tools – Dr. K. V. K. K. Prasad, Dreamtech.
Reference Books: 1. The craft of software testing - Brian Marick, Pearson Education. 2. Software Testing Techniques – SPD(Oreille) 3. Software Testing in the Real World – Edward Kit, Pearson. 4. Effective methods of Software Testing, Perry, John Wiley. 5. Art of Software Testing – Meyers, John Wiley

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III Year - II Semester	Code: 23AD6D05	L	T	P	C
		3	0	0	3

CRYPTOGRAPHY & NETWORK SECURITY
(Common to CSE(AI&DS)/AI&ML/CSE(AI&ML))

Course Objectives:
The main objectives of the course is to

- Explain the objectives of information security
- Explain the importance and application of each of confidentiality, integrity, authentication and availability
- Understand the basic categories of threats to computers and networks
- Discusses the Mathematics of Cryptography
- Discuss the fundamental ideas of Symmetric and Asymmetric Cryptographic Algorithms

Course Outcomes: Students are able

CO Number	Course Outcome	Blooms Level
CO 1	Analyze security principles and classical encryption techniques to address various network threats.	BL3
CO 2	Analyze mathematical foundations of symmetric and asymmetric cryptography for secure data encryption.	BL4
CO 3	Analyze symmetric and asymmetric encryption algorithms to ensure secure communication in cryptographic systems	BL3
CO 4	cryptographic hash functions, MACs, and digital signature algorithms for data integrity and authentication	BL3
CO 5	Analyze network and internet security protocols to ensure secure communication over web, IP, and email	BL4

UNIT I **15Hrs**

Security Concepts: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security Cryptography. Classical Encryption Techniques-symmetric cipher model, Substitution techniques, Transposition techniques, Rotor Machines, Stegnography.

UNIT II **15Hrs**

Introduction to Symmetric Cryptography: Algebraic Structures-Groups, Rings, Fields, GF(2^n) fields,

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Polynomials.

Mathematics of Asymmetric cryptography: Primes, Checking For Primness, Eulers phi-functions, Fermat's Little Theorem, Euler's Theorem, Generating Primes, Primality Testing, Factorization, Chinese Remainder Theorem, Quadratic Congruence, Exponentiation And Logarithm.

UNIT III **12Hrs**

Symmetric key Ciphers: Block Cipher principles, DES, AES, Blowfish, IDEA, Block cipher operation, Stream ciphers: RC4, RC5

Asymmetric key Ciphers: Principles of public key cryptosystems, RSA algorithm, Diffie-Hellman Key Exchange, Elgamal Cryptographic system, Elliptic Curve Arithmetic, Elliptic Curve Cryptography.

UNIT IV **15Hrs**

Cryptographic Hash Functions: Applications of Cryptographic Hash Functions, Two Simple Hash Functions, Requirements and Security, Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithms (SHA)

Message Authentication Codes: Message Authentication Requirements, Message Authentication Functions, Requirements for Message Authentication Codes, Security of MAC'S,MAC'S Based On Hash Functions: HMAC, MAC'S Based On Block Ciphers: DAA And CMAC

Digital Signatures: Digital Signatures, Elgamal Digital Signature Scheme, Elliptic Curve Digital Signature Algorithm, RSA-PSS Digital Signature Algorithm.

UNIT V **12Hrs**

Network and Internet Security: Transport-Level Security: Web Security Considerations, Transport Level Security, HTTPS, SSH.

IP Security: IP Security Overview, IP Security Policy, Encapsulating Security Payload, Authentication Header Protocol.

Electronic-Mail Security: Internet-mail Security, Email Format, Email Threats and Comprehensive Email Security, S/MIME, PGP.

Text Books:

1. 1. Cryptography and Network Security - Principles and Practice: William Stallings, Pearson Education, 7th Edition, 2017
2. Cryptography and Network Security: Behrouz A. Forouzan Debdeep, Mc Graw Hill, 3rd Edition, 2015

Reference Books:

1. Cryptography and Network Security: Atul Kahate, Mc Graw Hill, 3rd Edition
   Introduction to Cryptography with Coding Theory: Wade Trappe, Lawrence C.

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III Year – IISemester	Code: 23CS6D06	L	T	P	C
		3	0	0	3

DEVOPS
(Common to CSE, AIML, CSE(AI&ML), IT)

Course Objectives:

The main objectives of this course are to:

- Describe the agile relationship between development and IT operations.
- Understand the skill sets and high-functioning teams involved in DevOps and related methods to reach a continuous delivery capability.

Implement automated system update and DevOps lifecycle

Course Outcomes: Students are able to

CO Number	Course Outcome	Blooms Level
CO 1	Define the fundamentals of SDLC, Agile methodologies, and the concept of DevOps and its architecture.	BL1
CO 2	Describe the need for version control and apply Git features such as branching, staging, and collaboration	BL3
CO 3	Analyze Jenkins architecture (master-slave, pipeline basics) to automate and optimize build processes	BL4
CO 4	Use Docker commands to build, run, and manage containers, including publishing to Docker Hub	BL3
CO 5	Compare different configuration management tools such as Ansible, Puppet, and Chef.	BL5

UNIT I

Introduction to DevOps: Introduction to SDLC, Agile Model. Introduction to Devops. DevOps Features, DevOps Architecture, DevOps Lifecycle, Understanding Workflow and principles, Introduction to DevOps tools, Build Automation, Delivery Automation, Understanding Code Quality, Automation of CI/ CD. Release management, Scrum, Kanban, delivery pipeline, bottlenecks, examples

UNIT II

Source Code Management (GIT): The need for source code control, The history of source code management, Roles and code, source code management system and migrations. What is Version Control and GIT, GIT Installation, GIT features, GIT workflow, working with remote repository, GIT commands, GIT branching, GIT staging and collaboration. UNIT TESTING - CODE COVERAGE: Junit, nUnit & Code Coverage with Sonar Qube, SonarQube - Code Quality Analysis.

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UNIT-III

Build Automation - Continuous Integration (CI): Build Automation, What is CI Why CI is Required, CI tools, Introduction to Jenkins (With Architecture), jenkins workflow, jenkins master slave architecture, Jenkins Pipelines, PIPELINE BASICS - Jenkins Master, Node, Agent, and Executor Freestyle Projects & Pipelines, Jenkins for Continuous Integration, Create and Manage Builds, User Management in Jenkins Schedule Builds, Launch Builds on Slave Nodes.

UNIT IV

Continuous Delivery (CD): Importance of Continuous Delivery, CONTINUOUS DEPLOYMENT CD Flow, Containerization with Docker: Introduction to Docker, Docker installation, Docker commands, Images & Containers, DockerFile, Running containers, Working with containers and publish to Docker Hub.**Testing Tools:** Introduction to Selenium and its features, JavaScript testing.

UNIT V

Configuration Management - ANSIBLE: Introduction to Ansible, Ansible tasks, Roles, Jinja templating, Vaults, Deployments using Ansible.

CONTAINERIZATION USING KUBERNETES(OPENSHIFT): Introduction to Kubernetes Namespace & Resources, CI/CD - On OCP, BC, DC & ConfigMaps, Deploying Apps on Openshift Container Pods. Introduction to Puppet master and Chef.

Text Books:

1. Joyner, Joseph., Devops for Beginners: Devops Software Development Method Guide for Software Developers and It Professionals, 1st Edition Mihails Konoplows, 2015.
2. Alisson Machado de Menezes., Hands-on DevOps with Linux,1st Edition, BPB Publications, India, 2021.

Reference Books:

1. Len Bass, Ingo Weber, Liming Zhu. DevOps: A Software Architect's Perspective. Addison Wesley; ISBN-10
2. Gene Kim Je Humble, Patrick Debois, John Willis. The DevOps Handbook, 1st Edition, IT Revolution Press, 2016.
3. Verona, Joakim Practical DevOps, 1st Edition, Packt Publishing, 2016.
4. Joakim Verona. Practical Devops, Ingram short title; 2nd edition (2018). ISBN10: 1788392574
5. Deepak Gaikwad, Viral Thakkar. DevOps Tools from Practitioner's Viewpoint. Wiley publications. ISBN: 9788126579952

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BONAM VENKATA CHALAMAYYA ENGINERING COLLEGE ODALAREVU – 533 210, Andhra Pradesh, India
Autonomous

III Year - II Semester	Code: 23AD6D06	L	T	P	C
		3	0	0	3

RECOMMENDER SYSTEMS
(Common to CSE(AI&DS)/CSE(AI&ML))

Course Objectives:
The main objectives of the course is to

- Introduce recommender system functions, foundational linear algebra, rating analysis, and real-world applications with challenges.
- Understand collaborative filtering techniques, including user/item-based methods, model-based approaches, and system vulnerabilities.
- Learn content-based and knowledge-based recommendation techniques, including user/item profiling, retrieval, and reasoning methods.
- Understand hybrid recommendation strategies, their design models, implementation approaches, and associated limitations.
- Learn to evaluate recommender systems using various metrics and explore their role in social and personalized contexts.

Course Outcomes: Students are able

CO Number	Course Outcome	Blooms Level
CO 1	Analyze recommender system functions and linear algebra concepts to understand rating patterns and applications	BL3
CO 2	Collaborative filtering techniques and model-based approaches to build effective recommender systems	BL4
CO 3	Analyze content-based and knowledge-based recommendation techniques for personalized information retrieval	BL3
CO 4	Analyze hybrid recommendation strategies to enhance system performance using various integration designs.	BL4
CO 5	Evaluation methods and community-based approaches to assess and enhance recommender system effectiveness	BL4

UNIT I **15Hrs**

Introduction: Recommender system functions, Linear Algebra notation: Matrix addition, Multiplication, transposition, and inverses, covariance matrices, Understanding ratings, Applications of recommendation

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systems, Issues with recommender system.

UNIT II **15Hrs**

Collaborative Filtering:User-based nearest neighbour recommendation,Item-based nearest neighbour recommendation, Model based and pre-processing based approaches, Attacks on collaborative recommender systems

UNIT III **12Hrs**

Content-based recommendation: High level architecture of content-based systems, Advantages and drawbacks of content based filtering, Item profiles, discovering features of documents, obtaining item features from tags, representing item profiles, Methods for learning user profiles, Similarity based retrieval, Classification algorithms.

Knowledge based recommendation: Knowledge representation and reasoning, Constraint based recommenders, Case based recommenders.

UNIT IV **15Hrs**

Hybrid approaches: Opportunities for hybridization, Monolithic hybridization design: Feature combination, Feature augmentation, Parallelized hybridization design: Weighted, Switching, Mixed, Pipelined hybridization design: Cascade Meta-level, Limitations of hybridization strategies.

UNIT V **12Hrs**

Evaluating Recommender System: Introduction, General properties of evaluation research, Evaluation designs, Evaluation on historical datasets, Error metrics, Decision-Support metrics, User-Centred metrics.

Recommender Systems and communities: Communities, collaboration and recommender systems in personalized web search, Social tagging recommender systems, Trust and recommendations

Text Books:

1. Jannach D., Zanker M. and FelFering A., Recommender Systems: An Introduction, Cambridge University Press(2011), 1st ed.
2. Ricci F., Rokach L., Shapira D., Kantor B.P., Recommender Systems Handbook, Springer(2011), 1st ed.

Reference Books:

1. Manouselis N., Drachsler H., Verbert K., Duval E., Recommender Systems For Learning, Springer (2013), 1st ed.

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Autonomous

III Year - II Semester	Code: 23AD6D08	L	T	P	C
		3	0	0	3

COMPUTER VISION
(Common to CSE(AI&DS)/ AIML/CSE(AI&ML)

Course Objectives:

The main objectives of the course is to

- Understand camera models, radiometry, shading, and color perception in computer vision and image analysis.
- Learn linear filtering, edge detection, and texture analysis techniques for image processing and computer vision.
- Understand multi-view geometry and image segmentation techniques using clustering and human visual principles.
- Learn model-based segmentation, probabilistic fitting, and object tracking using linear dynamic models.
- Understand geometric camera models, calibration techniques, and model-based vision applications in robotics and imaging.

Course Outcomes: Students are able

CO Number	Course Outcome	Blooms Level
CO 1	Analyze camera models, lighting, shading, and color theory for realistic image formation and perception.	BL4
CO 2	Analyze linear filtering, edge detection, and texture analysis techniques for image processing applications.	BL3
CO 3	Analyze geometric and clustering techniques for multi-view reconstruction and image segmentation	BL4
CO 4	Analyze model fitting and probabilistic methods for segmentation and tracking in visual data.	BL4
CO 5	Analyze geometric camera models and calibration methods for vision-based localization and alignment.	BL2

UNIT I **15Hrs**

CAMERAS: Pinhole Cameras Radiometry–Measuring Light: Light in Space, Light Surfaces, Important Special Cases Sources, Shadows, And Shading: Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Inter reflections: Global Shading Models Color: The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color.

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UNIT II **15Hrs**

Linear Filters: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Edge Detection: Noise, Estimating Derivatives, Detecting Edges Texture0: Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids, Application: Synthesis by Sampling Local Models, Shape from Texture.

UNIT III **12Hrs**

The Geometry of Multiple Views: Two Views Stereopsis: Reconstruction, Human Stereopsis, Binocular Fusion, Using More Cameras Segmentation by Clustering: What Is Segmentation? Human Vision:GroupingandGetstalt,Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering.

UNIT ĪV **15Hrs**

Segmentation by Fitting a Model: The Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem, Robustness Segmentation and Fitting Using Probabilistic Methods: Missing Data Problems, Fitting, and Segmentation, The EM Algorithm in Practice, Tracking With Linear Dynamic Models: Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association, Applications and Examples

UNIT V **12Hrs**

Geometric Camera Models: Elements of Analytical Euclidean Geometry, Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations Geometric Camera Calibration: Least-Squares Parameter Estimation, A Linear Approach to Camera Calibration, Taking Radial Distortion into Account, Analytical Photogrammetry,

Case study: Mobile Robot Localization Model- Based Vision: Initial Assumptions, Obtaining Hypotheses by Pose Consistency, Obtaining Hypotheses by pose Clustering, Obtaining Hypotheses Using Invariants, Verification, Case study: Registration In Medical Imaging Systems, Curved Surfaces and Alignment.

Text Books:

1. David A. Forsyth and Jean Ponce: Computer Vision – A Modern Approach, PHI Learning (Indian Edition), 2009.

Reference Books:

1. E. R. Davies: Computer and Machine Vision – Theory, Algorithms and Practicalities, Elsevier (Academic Press), 4th edition, 2013.
2. R. C. Gonzalez and R. E. Woods "Digital Image Processing" Addison Wesley 2008. 3. Richard Szeliski "Computer Vision: Algorithms and Applications" Springer-Verlag London Limited 2011.

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III Year- I Semester	Code:23AM5L02	L	T	P	C
		0	0	3	1.5

DEEP LEARNING LAB

Course Objectives:

- To understand the basics of deep learning and neural networks through practical Experiments.
- To build and train models using datasets like MNIST, IMDB, and Reuters.
- To apply deep learning tools such as Keras, TensorFlow, and PyTorch.
- To work with Convolutional and Recurrent Neural Networks.
- To use pre-trained models and techniques like word embeddings and one-hot encoding.

CourseOutcomes:Studentsareableto

CO Number	CourseOutcome	Blooms Level
CO1	Implement deep neural networks to solve real world problems	BL3
CO2	Choose appropriate pre-trained model to solve real time problem	BL5
CO3	Interpret the results of two different deep learning models	BL4
CO4	Apply convolutional and recurrent neural networks for image and text data.	BL3
CO5	Perform data preprocessing techniques like one-hot encoding and word embeddings for deep learning models.	BL3

Software Packages required:

- Keras
- Tensorflow
- PyTorch

Sample Experiments:

Exercise – 1:

Implement multi-layer perceptron algorithm for MNIST Handwritten Digit Classification.

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Exercise – 2: Design a neural network for classifying movie reviews (Binary Classification) using IMDB dataset.
Exercise – 3: Design a neural Network for classifying news wires (Multi class classification) using Reuters dataset.
Exercise–4 Design a neural network for predicting house prices using Boston Housing Price dataset.
Exercise–5 Build a Convolution Neural Network for MNIST Handwritten Digit Classification.
Exercise–6 Build a Convolution Neural Network for simple image (dogs and Cats) Classification
Exercise–7 Use a pre-trained convolution neural network (VGG16)for image classification.
Exercise–8 Implement one hot encoding of words or characters.
Exercise-9 Implement word embedding's for IMDB dataset.
Exercise–10 Implement A Recurrent Neural Network for IMDB movie review classification problem.
Text Books: 1.RezaZadehandBharathRamsundar,"Tensorflow for Deep Learning", O'Reilly publishers, 2018
References: 1.https://github.com/fchollet/deep-learning-with-python-notebooks

Note:AttheendofLabcoursestudentshavetocompleteaMiniProject/CaseStudyforevaluation of Internal Marks.

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III Year –II Semester	Code:23AM6L04	L	T	P	C
		0	0	3	1.5

DATA VISUALIZATION LAB

Course Objectives:

- To visualize the different datasets using histograms, line charts.
- To understand the use of bar charts and box plots.
- To understand Scatter plots, mosaic plots
- To understand different Map visualizations
- To learn advanced graphs such as correlogram, heat map and 3D graphs.

Course Outcomes: Students are able to

CO Number	Course Outcome	Blooms Level
CO1	Visualize the different datasets using histograms, line charts.	BL3
CO2	Make use of bar chart sand box plots on different datasets	BL3
CO3	Apply Scatter plots, mosaic plots in R for different datasets	BL3
CO4	Apply different Map visualizations in R	BL3
CO5	Create advanced graphs such as correlogram, heat map and3D graphs.	BL6

Sample Experiments:

Exercise–1:

a) Load VADeaths (DeathRatesinVirginia) dataset in R and visualize the data using different histograms.

b) Load air quality dataset in R and visualize LaGuardia Airport's dialy maximum temperature using histogram.

Exercise–2:

Load Air Passengers dataset in R and visualize the data using line chart that shows increase in air passengers over given time period.

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Exercise–3:
a) Load iris dataset in R, visualize the data using different Bar Charts and also demonstrate the use of stacked plots.
b)Load air quality dataset in R and visualize ozone concentration in air.

Exercise–4
a) Load iris dataset in R, visualize the data using different Box plots including group by option and also use color palette to represent species.
b) Load air quality dataset in R and visualize air quality parameters using box plots.

Exercise–5
Visualize iris dataset using simples catter, multi variates catter plot and also visualizes catter plot matrix to visualize multiple variables across each other.

Exercise–6
Load diamonds dataset in R and visualize the structure in datasets with large data points using hexagon binning and also add color palette then use the

Exercise–7
Load Hair Eye Color dataset in R and plot categorical data using mosaic plot.

Exercise–8
Load mtcars dataset in R and visualize data using heat map.

Exercise–9
Install leaflet library in R and perform different map visualizations.

Exercise–10
Visualize iris dataset using 3d graphs such as scatter 3d,cloud, xyplot.

Exercise–11
Make use of correlogram to visualize data in correlation matrices for iris dataset.

Exercise–12
Install maps library in R and draw different map visualizations

References:

1. https://www.analyticsvidhya.com/blog/2015/07/guide-data-visualization-r/
2. https://www.geeksforgeeks.org/data-visualization-in-r/

Note: At the end of Lab course students have to complete a Mini Project/Case Study for evaluation of Internal Marks.

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III Year - II Semester	Code: 23HM6S02	L	T	P	C
		0	1	2	2

SOFT SKILLS
(Common to CSE,CSE-(AI&DS),AIML,CSE(AI&ML),IT)

Course Objectives:

- To equip the students with the skills to effectively communicate in English
- To train the students in interview skills, group discussions and presentation skills
- To motivate the students to develop confidence
- To enhance the students' interpersonal skills
- To improve the students' writing skills

Course Outcomes: Students are able

CO Number	Course Outcome	Blooms Level
CO 1	Demonstrate analytical thinking and effective listening skills, and apply verbal and non-verbal communication techniques in personal and professional settings.	BL2
CO 2	Develop self-management competencies such as stress, time, and anger management, and exhibit team building, leadership, and professional etiquette.	BL4
CO 3	Participate effectively in job-related scenarios such as group discussions and interviews, and prepare resumes tailored for employment opportunities	BL6
CO 4	Understand the dynamics of interpersonal relationships, their significance in a workplace, and apply strategies to manage different relationship styles effectively.	BL3
CO 5	Use correct grammar, sentence structure, and formats for professional written communication, including note-making, minutes writing, and email drafting.	BL5

UNIT – I

Analytical Thinking & Listening Skills: Self-Introduction, Shaping Young Minds - A Talk by Azim Premji (Listening Activity), Self – Analysis, Developing Positive Attitude, Perception.

Communication Skills: Verbal Communication; Non Verbal Communication (Body Language)

UNIT – II

Self-Management Skills: Anger Management, Stress Management, Time Management, Six Thinking Hats, Team Building, Leadership Qualities

Etiquette: Social Etiquette, Business Etiquette, Telephone Etiquette, Dining Etiquette

UNIT – III

Standard Operation Methods : Basic Grammars, Tenses, Prepositions, Pronunciation, Letter Writing; Note Making, Note Taking, Minutes Preparation, Email & Letter Writing

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UNIT-IV **Job-Oriented Skills:** Group Discussion, Mock Group Discussions, Resume Preparation, Interview Skills, Mock Interviews
UNIT-V **Interpersonal relationships**: Introduction, Importance, Types, Uses, Factors affecting interpersonal relationships, Accommodating different styles, Consequences of interpersonal relationships
Text books: 1. Barun K. Mitra, Personality Development and Soft Skills, Oxford University Press, 2011. 2. S.P. Dhanavel, English and Soft Skills, Orient Blackswan, 2010.
Reference books: 1. R.S.Aggarwal, A Modern Approach to Verbal & Non-Verbal Reasoning, S.Chand& Company Ltd., 2018.

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University Nominee	Subject Expert	Subject Expert	Industrial Expert	Alumni Expert	Chairman-BOS.

III Year - II Semester	Code: 23AC6T03	L	T	P	C
		2	0	0	-

TECHNICAL PAPER WRITING & IPR

(Common to CSE, CSE-(AI&DS), AIML, CSE(AI&ML), IT)

Course Objective: The course will explain the basic related to writing the technical reports and understanding the concepts related to formatting and structuring the report. This will help students to comprehend the concept of proofreading, proposals and practice

Course Outcomes: Students are able

CO Number	Course Outcome	Blooms Level
CO 1	Understand the structure and language of technical reports, and demonstrate the ability to plan and organize report content effectively.	BL2
CO 2	Use advanced features of word processors for technical documentation, including formatting, tracking changes, citations, bibliographies, and document protection techniques	BL3
CO 3	Understand the fundamentals of intellectual property rights including patents, copyrights, trademarks, and the international framework for protection and innovation.	BL4
CO 4	Draft clear, concise, and well-structured technical reports using appropriate visuals and adhere to principles of good grammar, spelling, and readability.	BL5
CO 5	Proofread documents for clarity and correctness, summarize content effectively, and develop oral and written presentation skills for technical proposals and reports.	BL6

Unit I:

Introduction: An introduction to writing technical reports, technical sentences formation, using transitions to join sentences, Using tenses for technical writing.

Planning and Structuring: Planning the report, identifying reader(s), Voice, Formatting and structuring the report, Sections of a technical report, Minutes of meeting writing

Unit II:

Drafting report and design issues: The use of drafts, Illustrations and graphics.

Final edits: Grammar, spelling, readability and writing in plain English: Writing in plain English, Jargon and final layout issues, Spelling, punctuation and Grammar, Padding, Paragraphs, Ambiguity.

Unit III:

Proofreading and summaries: Proofreading, summaries, Activities on summaries. **Presenting final reports:** Printed presentation, Verbal presentation skills, Introduction to proposals and practice.

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Unit IV: Using word processor: Adding a Table of Contents, Updating the Table of Contents, Deleting the Table of Contents, Adding an Index, Creating an Outline, Adding Comments, Tracking Changes, Viewing Changes, Additions, and Comments, Accepting and Rejecting Changes , Working with Footnotes and Endnotes, Inserting citations and Bibliography, Comparing Documents, Combining Documents, Mark documents final and make them read only., Password protect Microsoft Word documents., Using Macros,
Unit V: **Nature of Intellectual Property:** Patents, Designs, Trade and Copyright. Process of **Patenting and Development:** technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property
Text Books: 1. Kompal Bansal & Parshit Bansal, "Fundamentals of IPR for Beginner's", 1st Ed., BS Publications, 2016. 2. William S. Pfeiffer and Kaye A. Adkins, "Technical Communication: A Practical Approach", Pearson. 3. Ramappa,T., "Intellectual Property Rights Under WTO", 2nd Ed., S Chand, 2015.
Reference Books: 1. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011. 2. Day R, How to Write and Publish a Scientific Paper, Cambridge University Press(2006)
E-resources: 1. https://www.udemy.com/course/reportwriting/ 2. https://www.udemy.com/course/professional-business-english-and-technical-report-writing/ 3. https://www.udemy.com/course/betterbusinesswriting/

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