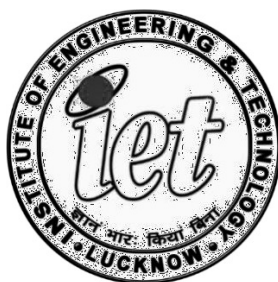


**INSTITUTE OF ENGINEERING & TECHNOLOGY
SITAPUR ROAD, LUCKNOW**



Evaluation Scheme & Syllabus

For

B.Tech. Fourth Year

**Computer Science & Engineering
(Artificial Intelligence)**

(Effective from the Session: 2025-26 onwards)

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
B. TECH. COMPUTER SCIENCE & ENGINEERING (ARTIFICIAL INTELLIGENCE)
CURRICULUM STRUCTURE

SEMESTER- VII

Sl. No.	Course Code	Course Title	Type of Course	Periods			Evaluation Scheme				End Semester		Total	Credit
				L	T	P	CT	TA	Total	PS	TE	PE		
1	IHU-701	Project Management and Entrepreneurship	HSMC	3	0	0	20	10	30	-	70	-	100	3
2	Program Elective-IV	Program Elective Course -IV	PEC Regular Class Room Teaching/ MOOCS	3	0	0	20	10	30	-	70	-	100	3
3	IOE070-IOE079	Open Elective-II	OEC	3	0	0	20	10	30	-	70	-	100	3
4	IOE080-IOE089	Open Elective-III	OEC Regular Class Room Teaching/ MOOCS	3	0	0	20	10	30	-	70	-	100	3
5	IAI751	Project	PL	0	0	8	-	-	-	100	-	-	100	4
6	IAI752	Internship Assessment/ Mini Projects/ Start-up & Entrepreneurship Assessment	PL	0	0	2	-	-	-	100	-	-	100	2
7		MOOCs (for Honours Degree) /Minor Degree												
		Total		12	0	10							600	18

Internship Assessment/ Mini Project (5-6 weeks) conducted during summer break after VIth semester will be assessed during VII semester.

SEMESTER- VIII

Sl. No.	Course Code	Course Title	Type of Course	Periods			Evaluation Scheme				End Semester		Total	Credit
				L	T	P	CT	TA	Total	PS	TE	PE		
1	IAI851	Project/Industrial Project	PL	0	0	24	-	-	-	150	-	350	500	12
2		MOOCs (for Honours Degree) /Minor Degree	MOOC'S											
		Total		0	0	24							500	12

Program Elective-IV

1. ICS071- Internet of Things
2. ICS072- Blockchain Technology
3. ICS073- Software Project Management
4. ICS074- Service Oriented Architecture
5. IAI071 - Data Analytics
6. IAI072- Natural Language Processing and Text Analysis
7. IAI073- Distributed Database
8. IAI074- Soft Computing
9. IAI075- Principles of Generative AI

B.TECH. (Computer Science and Engineering) SEVENTH SEMESTER (DETAILED SYLLABUS)

ICS071		Internet of Things	
Course Outcome (CO)		Bloom’s Knowledge Level (KL)	
At the end of course, the student will be able to			
CO1	Demonstrate basic concepts, principles and challenges in IoT.		K ₂
CO2	Illustrate functioning of hardware devices and sensors used for IoT.		K ₂
CO3	Analyze network communication aspects and protocols used in IoT.		K ₄
CO4	Apply IoT for developing real life applications using Arduinio programming.		K ₃
CO5	Develop IoT infrastructure for popular applications		K ₃ , K ₄
DETAILED SYLLABUS			3-0-0
Unit	Topic		Proposed Lectures
I	Internet of Things (IoT): Vision, Definition, Conceptual Framework, Architectural view, technology behind IoT, Sources of the IoT, M2M Communication, IoT Examples. Design Principles for Connected Devices: IoT/M2M systems layers and design standardization, communication technologies, data enrichment and consolidation, ease of designing and affordability.		08
II	Hardware for IoT: Sensors, Digital sensors, Actuators, Radio Frequency Identification (RFID) technology, Wireless Sensor Networks, participatory sensing technology. Embedded Platforms for IoT: Embedded computing basics, Overview of IOT supported Hardware platforms such as Arduino, Net Arduino, Raspberry pi, Beagle Bone, Intel Galileo boards and ARM cortex.		08
III	Network & Communication aspects in IoT: Wireless Medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination.		08
IV	Programming the Arduinio: Arduinio Platform Boards Anatomy, Arduinio IDE, coding- using emulator, using libraries, additions in Arduinio, programming the Arduinio for IoT.		08
V	Design challenges in IOT: Development Challenges, Security Challenges, IoT Applications: E-health, City Automation, Home automation.		08
Note: The instructor of the course is advised to include suitable case studies/practical assignments as per his/her wisdom.			
Books:			
1. O. Hersent, D. Boswarthick, O. Elloumi “The Internet of Things key applications and protocols”,Wiley Publications, 2012			
2. Jeeva Jose “Internet of Things”, Khanna Publishing House,2025			
3. Shriram K Vasudevan, RMD Sundaram, Abhishek S Nagarajan “Internet of Things”, 3 rd Edition, Wiley Publications, 2025			
4. Michael Miller “The Internet of Things” by Pearson,2015			
5. Raj Kamal “Internet of Things”, McGraw-Hill, 1 st Edition, 2016			
6. Arshdeep Bahga, Vijay Madisetti “Internet of Things “A hands on approach”, 1 st Edition, VPI publications, 2014			
7.Adrian McEwen, Hakin Cassimally “Designing the Internet of Things” Wiley Publications,2014			

ICS072 Blockchain Technology		
Course Outcome(CO)		Bloom's Knowledge Level (KL)
At the end of course, the student will be able to		
CO1	Describe the basic understanding of Blockchain architecture along with its primitive.	K ₁ ,K ₂
CO2	Explain the requirements for basic protocol along with scalability aspects.	K ₂ ,K ₃
CO3	Design the consensus process using frontend and backend.	K ₃ ,K ₄
CO4	Apply Blockchain techniques for different use cases like Finance, Trade/Supply and Government activities.	K ₄ ,K ₅
CO5	Study the application of Blockchain in Governance, social welfare, and Cryptography.	K ₂
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lectures
I	Introduction to Blockchain: Digital Money to Distributed Ledgers, Design Primitives: Protocols, Security, Consensus, Permissions, Privacy. Blockchain Architecture and Design: Basic Crypto primitives: Hash, Signature, Hash chain to Blockchain, Basic consensus mechanisms	08
II	Consensus: Requirements for the consensus protocols, Proof of Work (PoW), Scalability aspects of Blockchain consensus protocols Permissioned Blockchains: Design goals, Consensus protocols for Permissioned Blockchains	08
III	Hyperledger Fabric (A): Decomposing the consensus process, Hyperledger fabric components, Chaincode Design and Implementation, Beyond Chaincode: fabric SDK and Front End(b) Hyperledger composer tool	08
IV	Design Challenges: Blockchain in Financial Software and Systems (FSS):(i) Settlements, (ii) KYC, (iii)Capital markets, (iv) Insurance Blockchain in trade/supply chain: (i) Provenance of goods, visibility, trade/supply chain finance, invoice management discounting, etc	08
V	Area of Application: Blockchain for Government: (i) Digital identity, land records and other kinds of record keeping between government entities, (ii) Public distribution system social welfare systems Blockchain Cryptography, Privacy and Security on Blockchain	08
Note: The instructor of the course is advised to include suitable case studies/practical assignments as per his/her wisdom. Books: 1. S. Asharaf, Sivadas Neelima, S. Adarsh, and Sumi Maria Abraham “Advanced Blockchain Technologies”, Wiley Publications, 2025 2. Andreas M. Antonopoulos “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”, O’Reilly Publications, 2014 3. Melanie Swan “Blockchain”, O’Reilly Publications, 2015 4. Don Tapscott, Alex Tapscott “Blockchain Revolution”, Penguin, New York, 2016 5. Xu, Weber, Staples “Architecture for Blockchain Applications”, Springer Publications, 2019 6. Hyperledger Fabric - https://www.hyperledger.org/projects/fabric 7. Zero to Blockchain - An IBM Redbooks course, by Bob Dill, David Smits - https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html		

ICS073 Software Project Management		
Course Outcome(CO)		Bloom's Knowledge Level (KL)
At the end of course, the student will be able to		
CO1	Explain SPM basics, project planning and estimation methods	K ₂
CO2	Understand Work Breakdown Structure (WBS) and software review techniques.	K ₂
CO3	Analyze earned value data and project performance indicators	K ₄
CO4	Analyze software quality through testing and Software Quality Assurance (SQA) models.	K ₄
CO5	Apply risk and configuration management using software tools.	K ₃
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lectures
I	Introduction and Software Project Planning: Fundamentals of Software Project Management (SPM), Need Identification, Vision and Scope document, Project Management Cycle, Software project estimation, Estimation methods, Estimation models, Decision process.	08
II	Project Organization and Scheduling Project Elements: Work Breakdown Structure (WBS), Error Tracking, Software Reviews, Types of Review: Inspections, Walkthroughs, Code Reviews, Pair Programming.	08
III	Project Monitoring and Control: Dimensions of Project Monitoring & Control, Cost Variance (CV), Schedule Variance (SV), Cost Performance Index (CPI), Schedule Performance Index (SPI), Interpretation of Earned Value Indicators,	08
IV	Software Quality Assurance and Testing Objectives: Testing Principles, Test Plans, Test Cases, Types of Testing, Levels of Testing, Test Strategies, Program Correctness, Program Verification & validation, Testing Automation & Testing Tools, Concept of Software Quality ,The SEI Capability Maturity Model CMM.	08
V	Project Management and Project Management Tools: Software Configuration Items and tasks, Baselines, Plan for Change, Change Control, Change Requests Management, Version Control, Risk Management: Risks and risk types, Risk Breakdown Structure (RBS), Risk Management Process: Risk identification, Risk analysis, Risk planning, Risk monitoring.	08
Books: 1. M.Cotterell "Software Project Management", Tata Mc Graw- Hill Publication,1999 2. Royce "Software Project Management", Pearson Education,2000 3. Kieron Conway "Software Project Management", Dreamtech Press,2001 4. S.A. Kelkar "Software Project Management", PHI Publication,2012 5. H. R. Kerzner "Project Management: A Systems Approach to Planning, Scheduling, and Controlling" Wiley, 2017 6. Mohapatra "Software Project Management", Cengage Learning, 2011 7. P. K. Agarwal, S.A.M. Rizvi, "Software Project Management", Khanna Publishing House,2010		

ICS074 Service Oriented Architecture		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course, the student will be able to		
CO 1	Understand of service oriented computing paradigm, and its evolution.	K ₁ , K ₂
CO 2	Applications of Service Oriented Architecture of B2B integration.	K ₂ , K ₃ ,
CO 3	Application of standard technologies for web services communication, and Centralize registry system.	K ₂ , K ₃
CO 4	Analysis of the services coordination protocols and composition.	K ₃ , K ₄
CO 5	Design of a problem of SOA using .NET/ J2EE.	K ₄ , K ₅
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lectures
I	Introduction: SOA and MSA Basics: Service Orientation in Daily Life, Evolution of SOA and MSA. Service oriented Architecture and Microservices architecture, Standards and Guidelines for SOA. Applications: Considerations for Service-oriented Applications, Patterns for SOA, Pattern-based Architecture for Service-oriented Applications, Composite Applications.	08
II	Web Services Architecture – Web services Architecture and its characteristics, Web Services and their approach to distributed computing. B2B Integration before Web Services. Requirement of Web Services, Web services technologies. Internal and external Architecture of Web Services. Web services description language (WSDL).	08
III	SOAP: Simple Object Access Protocol, Inter-application communication and wire protocols, Structure of a SOAP message, Processing of SOAP message, Reliable messaging, SOAP HTTP binding, Error handling in SOAP. Registering and Discovering Services: The role of service registries, Universal Description, Discovery, and Integration (UDDI), Architecture and information in UDDI, Understanding technical models (tModels), UDDI Registry API.	08
IV	Service coordination protocols: Introduction to coordination protocols, Infrastructure for coordination protocols, transaction in web services. Service composition: Service composition models, Exception handling, Dependencies between Coordination and Composition, BPEL: Business Process Execution Language for web Services.	08
V	Overview of .NET and J2EE in SOA development. Publishing and Consuming REST-Based XML web services, Publishing and Consuming REST-Based JSON (JavaScript Object Notation) web services, Session tracking in a SOAP Web Service, Consuming a Database-Driven SOAP Web Services.	08
Note: Students are encourage to develop an application problem for real world requirement/ area as mini project/ assignment. Books: - Shankar Kambhampaty; Service - Oriented Architecture & Micro services Architecture: For Enterprise, Cloud, Big Data and Mobile; Wiley; 3rd Edition; 2018 - Gustavo Alonso et al, “Web services Concepts Architecture ans application”, Springer-Verlag Berlin Heidelberg New York in 2004 - Thomas Erl, “Service-Oriented Architecture: Concepts, Technology, and Design”, Pearson Education, 2005 Reference Books: - Newcomer, Lomow“ Understanding SOA with Web Services”, Pearson Education, 2005. S. Chatterjee, J.Webber, “Developing Enterprise Web Services, An Architect’s Guide”, Pearson Education, 2005. D. Woods and T. Mattern,“ Enterprise SOA Designing IT for Business Innovation” O’REILLY, First Edition, 2006 - Deitel and Deitel, “ Java How to program” Pearson India Education, 2016		

IAI071 Data Analytics		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course, the student will be able to		
CO 1	Describe the life cycle phases of Data Analytics through discovery, planning and building.	K ₁ ,K ₂
CO 2	Understand and apply Data Analysis Techniques.	K ₂ , K ₃
CO 3	Implement various Data streams.	K ₃
CO 4	Understand item sets, Clustering, frame works & Visualizations.	K ₂
CO 5	Apply R tool for developing and evaluating real time applications.	K ₃ ,K ₅
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lectures
I	Introduction to Data Analytics: Sources and nature of data, classification of data, introduction to Big Data platform, need of data analytics, evolution of analytic scalability. Introduction to R/Python: Graphical user interfaces, data import and export, attribute and data types.	08
II	Data Analytics Lifecycle: Need, key roles for successful analytic projects, various phases of data analytics lifecycle – discovery, data preparation, model planning, model building, communicating results, operationalization. Data Analysis: Regression modeling, multivariate analysis, Bayesian modeling, inference and Bayesian networks, support vector and kernel methods, neural networks: learning and generalisation, competitive learning, principal component analysis and neural networks.	08
III	Mining Data Streams: Introduction to streams concepts, stream data model and architecture, stream computing, Real-time Analytics Platform (RTAP) applications, Case studies – real time sentiment analysis, stock market predictions.	08
IV	Frequent Item sets and Clustering: Mining frequent item sets, market based modelling, Apriori algorithm, handling large data sets in main memory, limited pass algorithm, counting frequent item sets in a stream, clustering techniques: hierarchical, K-means, Clustering high dimensional data, CLIQUE and ProCLUS, frequent pattern based clustering methods, clustering in non-Euclidean space, clustering for streams and parallelism.	08
V	Frame Works and Visualization: MapReduce, Hadoop, Pig, Hive, HBase, MapR, NoSQL Databases, S3, Hadoop Distributed File Systems, Visualization: visual data analysis techniques. Advance R - Descriptive statistics, exploratory data analysis, visualization before analysis, analytics for unstructured data.	08
Books: 1. Michael Berthold, David J. Hand, “Intelligent Data Analysis”, Springer, 2006 2. Anand Rajaraman, Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2014 3. Bill Franks, “Taming the Big Data Tidal wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, John Wiley & Sons, 2012 4. John Garrett, “Data Analytics for IT Networks: Developing Innovative Use Cases”, Pearson Education, 2019 5. M. Minelli, M. Chambers, A. Dhiraj, "Big Data, Big Analytics: Emerging Business”, John Wiley & Sons, 2013		

IAI072 Natural Language Processing and Text Analysis		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to		
CO 1	Understand the fundamentals of text analytics and natural language processing	K ₂
CO 2	Learn understand the use of Natural Language Processing	K ₂ , K ₃
CO 3	Apply and analyze semantics of sentences and pragmatic	K ₃ , K ₄
CO 4	Addresses the basic Speech Production and related parameters of speech.	K ₂ , K ₃
CO 5	Show the computation and use of techniques such as short time Fourier transform, linear predictive coefficients and other coefficients in the analysis of speech.	K ₂ , K ₄
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lectures
I	Introduction to natural language processing (NLP) and text analytics. Linguistics Essentials. Foundations of text processing: tokenization, stemming, stopwords removal, lemmatization, part-of-speech tagging, syntactic parsing.	08
II	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.	08
III	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, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.	08
IV	Basic Concepts of Speech Processing: Speech Fundamentals: Articulatory Phonetics – Production and Classification Of Speech Sounds; Acoustic Phonetics – Acoustics Of Speech Production; Review Of Digital Signal Processing Concepts; Short-Time Fourier Transform, Filter-Bank And LPC Methods.	08
V	Speech-Analysis: Features, Feature Extraction And Pattern Comparison Techniques: Speech Distortion Measures– Mathematical And Perceptual – Log–Spectral Distance, Cepstral Distances, Weighted Cepstral Distances And Filtering, Likelihood Distortions, Spectral Distortion Using A Warped Frequency Scale, LPC, PLP And MFCC Coefficients, Time Alignment And Normalization – Dynamic Time Warping, Multiple Time – Alignment Paths. Speech Modeling: Hidden Markov Models: Markov Processes, HMMs – Evaluation, Optimal State Sequence – Viterbi Search, Baum-Welch Parameter Re-Estimation, Implementation Issues.	08
Books: 1. Daniel Jurafsky, James H. Martin, “Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech”, Pearson Publication, 2014. 2. Steven Bird, Ewan Klein and Edward Loper, “Natural Language Processing with Python”, First Edition, O'Reilly Media, 2009. 3. Lawrence Rabiner, Biing-Hwang Juang, “Fundamentals Of Speech Recognition”, Pearson Education, 2003. 4. Daniel Jurafsky And James H Martin, “Speech And Language Processing – An Introduction To Natural Language Processing, Computational Linguistics, And Speech Recognition”, Pearson Education, 2002. 5. Frederick Jelinek, “Statistical Methods Of Speech Recognition”, MIT Press, 1997. 6. Breck Baldwin, “Language Processing with Java and LingPipe Cookbook”, Atlantic Publisher, 2015. 7. Richard M Reese, “Natural Language Processing with Java”, O'Reilly Media, 2015. 8.		

IAI073 Distributed Database		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to		
CO 1	Understand and analyze the concepts of transactions and schedules in database systems.	K ₂ , K ₄
CO 2	Evaluate and apply various concurrency control protocols to ensure serializability in database systems.	K ₄ , K ₅
CO 3	Examine and implement distributed transaction management strategies in fragmented and replicated databases.	K ₄ , K ₅
CO 4	Assess recovery mechanisms and algorithms to maintain atomicity and consistency in distributed database systems.	K ₃ , K ₅
CO 5	Apply query processing techniques and optimization strategies in distributed databases for efficient performance.	K ₃ , K ₅
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lectures
I	Transaction and schedules, Concurrent Execution of transaction, Conflict and View Serializability, Testing for Serializability, Concept in Recoverable and Cascadeless schedules.	08
II	Lock based protocols, time stamp based protocols, Multiple Granularity and Multiversion Techniques, Enforcing serializability by Locks, Locking system with multiple lock modes, architecture for Locking scheduler.	08
III	Distributed Transaction Management, Data Distribution, Fragmentation and Replication Techniques, Distributed Commit, Distributed Locking schemes, Long duration transactions, Moss Concurrent protocol.	08
IV	Issues of Recovery and atomicity in Distributed Databases, Traditional recovery Techniques, Long based recovery, Recovery with Concurrent Transaction, Recovery in Message passing systems, Checkpoints, Algorithms for recovery line, Concept in Orphan and Inconsistent Messages.	08
V	Protocol Query Processing, Multiway Joins, Semi Joins, Cost based query optimization for distributed database, Updating replication data, protocol for Distributed Deadlock Detection, Eager and Lazy Replication Techniques.	08
Books: 1. Silberschatz, korth and Sudershan, "Database System Concept", Mc Graw Hill,1999 2. Ramakrishna and Gehrke, "Database Management System", Mc Graw Hill,2002 3. Garcia-Molina, Ullman, Widm, "Database System Implementation, Pearson Education",1999 4. S. Ceri and G. Pelagatti, "Distributed Database", Tata Mc Graw Hill,2017 5. Singhal and Shivratri, "Advance Concepts in Operating Systems", MC Graw Hill,2017		

IAI074 SOFT COMPUTING		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course, the student will be able to		
CO1	Understand artificial neural networks and its applications.	K ₁ , K ₂
CO2	Understand and apply fuzzy logic and its applications.	K ₂ , K ₃
CO3	Apply and solving multi-objective optimization problems using evolutionary algorithms (MOEAs).	K ₁ , K ₂
CO4	Apply Soft computing to solve problems in varieties of application domains.	K ₂ , K ₄
CO5	Solve single-objective optimization problems using GAs.	K ₂ , K ₅
DETAILED SYLLABUS		
Unit	Topics	Proposed Lectures
I	Introduction to Soft Computing: Concept of computing systems. "Soft" computing versus "Hard" computing, Characteristics of Soft computing, Some applications of Soft computing techniques	08
II	Fuzzy logic: Introduction, Fuzzy sets and membership functions. Operations on Fuzzy sets. Fuzzy relations, rules, propositions, implications and inferences. Defuzzification techniques. Fuzzy logic controller design. Some applications of Fuzzy logic.	08
III	Genetic Algorithms: Concept of "Genetics" and "Evolution" and its application to probabilistic search techniques, Basic GA framework and different GA architectures. GA operators: Encoding, Crossover, Selection, Mutation, etc., solving single-objective Optimization problems using GAs.	08
IV	Multi-objective Optimization Problem Solving: Concept of multi-objective optimization problems (MOOPs) and issues of solving them. Multi-Objective Evolutionary Algorithm (MOEA). Non-Pareto approaches to solve MOOPs Pareto-based approaches to solve MOOPs. Some applications with MOEAs.	08
V	Artificial Neural Networks: Biological neurons and it's working. Simulation of biological neurons to problem solving. Different ANNs architectures. Training techniques for ANNs. Applications of ANNs to solve some real life problems.	08
Books: 1. F. Martin, Mcneill, and Ellen Thro, "Fuzzy Logic: A Pratical approach", AP Professional, 2000 2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", 3rd Edition, Willey, 2010 3. Nikola K. Kasabov, "Foundations of Neural Networks, Fuzzy Systems, and Knowldge Engineering", MIT Press, 1998 4. Ahmed M. Ibrahim, "Fuzzy Logic for Embedded Systems Applications", Elesvier Press, 2004 5. Melanie Mitchell, "An Introduction to Genetic Algorithms", MIT Press, 2000 6. David E. Goldberg, "Genetic Algorithms In Search, Optimization And Machine Learning", Pearson Education, 2002.		

IAI075 Principles of Generative AI		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course, the student will be able to		
CO 1	Understand the fundamental concepts and real-world applications of Artificial Intelligence and Generative AI tools and platforms.	K2
CO 2	Apply prompt engineering techniques to design optimized and context-aware prompts for generative tasks in various AI platforms.	K3
CO 3	Analyze the effectiveness of generative AI in domains such as education, office automation, marketing, and healthcare through specific use cases.	K4
CO 4	Evaluate and compare various generative AI tools for content generation, code assistance, media creation, and automation.	K5
CO5	Design AI-based workflows for real-world applications using tools like ChatGPT, GitHub Copilot, Jasper, and others	K5
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lecture
I	Foundations and Fundamentals of Generative AI: Introduction to Artificial Intelligence: Definitions, Foundations, Scope, and Applications, Implications of AI across industries, Fundamentals of Generative AI: Concept, Evolution, Capabilities, Applications of Generative AI in various domains; Introduction to Generative AI platforms: ChatGPT (OpenAI), Gemini (Google), GitHub Copilot(Microsoft); Text and Image generation using LLM	08
II	Prompt Engineering and Prompt Optimization Techniques: Basics of Prompt Engineering, Types of Prompts: Declarative, Interrogative, Instructional, Advanced Prompt Engineering: Chain-of-Thought Prompting, Zero-shot and Few-shot Prompting, Prompt Optimization Techniques, Use Cases and Practical Examples in Coding, Writing, and Customer Interaction	08
III	Generative AI Applications in Workplace and Education: AI in Office Productivity: Email Writing, Report Drafting, Minutes of Meeting (MoM), Proposal Writing, Summarization, and Task Automation: Generative AI in Education: AI for Content Creation, Summarization, and Explanation, Curriculum Design using AI Tools, AI in Assessment, Feedback, and Visualization (e.g., Mind maps, Infographics)	08
IV	Domain-Specific Applications of Generative AI: Generative AI in Digital Marketing: Content Strategy for YouTube, Facebook, Instagram, X (Twitter), LinkedIn and AI in Professional Branding, Email Marketing Automation and AI in E-Commerce; Generative AI in Healthcare and Agriculture: Diagnosis Assistance, Patient Data Summarization, Crop Monitoring, Yield Prediction using AI	08
V	Creative and Technical Aspects of Generative AI: AI-Assisted Programming (e.g., Code Generation, Auto Debugging using Copilot, GPT-4), Generative AI in Creative Domains: Image & Design Generation (DALL·E, Midjourney), Music Composition with AI Tools; AI in Gaming & Animation (e.g., Scenario Generation, NPC Scripting), Customer Interaction Automation: Chatbots, Virtual Assistants, and Voice AI; Exploration of Popular AI Tools & Platforms: Runway ML, Jasper, Synthesia, Lumen5, Bard, etc.	08
Books: 1. J. Emerson, “<i>Ripples of generative AI: Navigating AI's impact on society</i>”, AI Press,2023 2. Paul Singh, Anurag Karuparti, “Generative AI for Cloud Solutions: Architect modern AI LLMs in secure, scalable, and ethical cloud environments”,Packt Publishing Ltd, 2024 3. Valentina Alto, “Modern Generative AI with ChatGPT and OpenAI Models: Leverage the Capabilities of OpenAI's LLM for Productivity and Innovation with GPT3 and GPT4”, Packt Publishing Ltd,2023 4. Tanmoy Chakraborty “Introduction to Large Language Models Generative AI for Text”, Willey, 2025 5. R. Pandit, <i>Generative AI</i> (Hardcover), Notion Press,2024 6. OpenAI. (n.d.). <i>OpenAI</i>, from https://openai.com/ 7. Google. (n.d.). <i>Gemini</i>, from https://gemini.google.com/ 8. Microsoft. (n.d.). <i>Copilot</i>, from https://copilot.microsoft.com/chats/VkLP7TbPcVtu4dDjpDVTv		

B.Tech. VIIth Semester

List of Open Elective-II and Open Elective-III

To be offered by CSE Department:

1. Digital & Social Media Marketing (Open for all branches)
2. Data Warehousing and Data Mining (For student other than CSE/CSE(AI))
3. Big Data (For student other than CSE/ CSE(AI))
4. Natural Language Processing (For student other than CSE/CSE(AI))

IOE083 Digital & Social Media Marketing		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course, the student will be able to		
CO 1	Understand the Foundations of Digital Marketing.	K1, K2
CO 2	Create and Manage Social Media Content.	K3
CO 3	Acquire and Engage Users through Digital Channels.	K1 , K2
CO 4	Design and Implement Digital Marketing Strategies	K3
CO 5	Analyze Digital Innovation and Emerging Trends	K1 , K2
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lectures
I	Introduction to Digital Marketing: The new digital world - trends that are driving shifts from traditional marketing practices to digital marketing practices, the modern digital consumer and new consumer's digital journey. marketing strategies for the digital world-latest practices.	08
II	Social Media Marketing -Introduction to Blogging, Create a blog post for your project. Include headline, imagery, links and post, Content Planning and writing; e-commerce: optimizing e-commerce performance, transactions ; Introduction to Facebook, Twitter, Google +, LinkedIn, YouTube, Instagram, and Pinterest; their channel advertising and campaigns	08
III	Acquiring & Engaging Users through Digital Channels: Understanding the relationship between content and branding and its impact on sales, search engine marketing, mobile marketing, video marketing, and social-media marketing, marketing gamification; Online campaign management; using marketing analytic tools to segment, target and position; overview of search engine optimization (SEO)	08
IV	Designing Organization for Digital Success: Digital transformation, digital leadership principles, online P.R. and reputation management. ROI of digital strategies, how digital marketing is adding value to business, and evaluating cost effectiveness of digital strategies.	08
V	Digital Innovation and Trends: The contemporary digital revolution, digital transformation framework; security and privatization issues with digital marketing understanding trends in digital marketing – Indian and global context, online communities and co-creation.	08
Reference books: 1. Moutsy Maiti: Internet Marketing, Oxford University Press India, 2017 2. Vandana, Ahuja; Digital Marketing, Oxford University Press India Publication, November, 2015. 3. Eric Greenberg, and Kates, Alexander; Strategic Digital Marketing: Top Digital Experts Share the Formula for Tangible Returns on Your Marketing Investment; McGraw-Hill Professional October, 2013. 4. Ryan, Damian; Understanding Digital Marketing: marketing strategies for engaging the digital generation; Kogan Page, 3rd Edition, 2014. 5. Tracy L. Tuten & Michael R. Solomon, "Social Media Marketing", Sage Publication, 2017		

IOE084 Data Warehousing and Data Mining		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to understand		
CO 1	Be familiar with mathematical foundations of data mining tools.	K1, K2
CO 2	Understand and implement classical models and algorithms in data warehouses and data mining	K3
CO 3	Characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering.	K1, K2
CO 4	Master data mining techniques in various applications like social, scientific and environmental context.	K3
CO 5	Develop skill in selecting the appropriate data mining algorithm for solving practical problems.	K1 , K2
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lectures
I	Data Warehousing: Overview, Definition, Data Warehousing Components, Building a Data Warehouse, Warehouse Database, Mapping the Data Warehouse to a Multiprocessor Architecture, Difference between Database System and Data Warehouse, Multi-Dimensional Data Model, Data Cubes, Stars, Snow Flakes, Fact Constellations, Concept	08
II	Data Warehouse Process and Technology: Warehousing Strategy, Warehouse /management and Support Processes, Warehouse Planning and Implementation, Hardware and Operating Systems for Data Warehousing, Client/Server Computing Model & Data Warehousing. Parallel Processors & Cluster Systems, Distributed DBMS implementations, Warehousing Software, Warehouse Schema Design	08
III	Data Mining: Overview, Motivation, Definition & Functionalities, Data Processing, Form of Data Pre-processing, Data Cleaning: Missing Values, Noisy Data, (Binning, Clustering, Regression, Computer and Human inspection), Inconsistent Data, Data Integration and Transformation. Data Reduction:- Data Cube Aggregation, Dimensionality reduction, Data Compression, Numerosity Reduction, Discretization and Concept hierarchy generation, Decision Tree.	08
IV	Classification: Definition, Data Generalization, Analytical Characterization, Analysis of attribute relevance, Mining Class comparisons, Statistical measures in large Databases, Statistical-Based Algorithms, Distance-Based Algorithms, Decision Tree-Based Algorithms. Clustering: Introduction, Similarity and Distance Measures, Hierarchical and Partitional Algorithms. Hierarchical Clustering- CURE and Chameleon. Density Based Methods-DBSCAN, OPTICS. Grid Based Methods- STING, CLIQUE. Model Based Method –Statistical Approach, Association rules: Introduction, Large Item sets, Basic Algorithms, Parallel and Distributed Algorithms, Neural Network approach.	08
V	Data Visualization and Overall Perspective: Aggregation, Historical information, Query Facility, OLAP function and Tools. OLAP Servers, ROLAP, MOLAP, HOLAP, Data Mining interface, Security, Backup and Recovery, Tuning Data Warehouse, Testing Data Warehouse. Warehousing applications and Recent Trends: Types of Warehousing Applications, Web Mining, Spatial Mining and Temporal Mining	08
Reference books: 1. Jiawei Han, Micheline Kamber, Jian Pei “DATA MINING: Concepts and Techniques”, Elsevier, 2007. 2. Alex Berson, Stephen J. Smith, “Data Warehousing, Data-Mining & OLAP”, TMH, 2017 3. Mark Humphries, Michael W. Hawkins, Michelle C. Dy, “Data Warehousing: Architecture and Implementation”, Pearson, 1998 4. Margaret H. Dunham, S. Sridhar, “Data Mining: Introductory and Advanced Topics” Pearson Education, 2006 5. Arun K. Pujari, “Data Mining Techniques” Universities Press, 2001 6. Pieter Adriaans, Dolf Zantinge, “Data-Mining”, Pearson Education, 1996		

IOE076 Big Data		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to		
CO 1	Demonstrate knowledge of Big Data Analytics concepts and its applications in business.	K ₁ ,K ₂
CO 2	Demonstrate functions and components of Map Reduce Framework and HDFS.	K ₁ ,K ₂
CO 3	Discuss Data Management concepts in NoSQL environment.	K ₆
CO 4	Explain process of developing Map Reduce based distributed processing applications.	K ₂ ,K ₅
CO 5	Explain process of developing applications using HBASE, Hive, Pig etc.	K ₂ ,K ₅
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lectures
I	Introduction to Big Data: Types of digital data, history of Big Data innovation, introduction to Big Data platform, drivers for Big Data, Big Data architecture and characteristics, 5 Vs of Big Data, Big Data technology components, Big Data importance and applications, Big Data features – security, compliance, auditing and protection, Big Data privacy and ethics, Big Data Analytics, Challenges of conventional systems, intelligent data analysis, nature of data, analytic processes and tools, analysis vs reporting, modern data analytic tools.	06
II	Hadoop: History of Hadoop, Apache Hadoop, the Hadoop Distributed File System, components of Hadoop, data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, Hadoop Echo System. Map Reduce: Map Reduce framework and basics, how Map Reduce works, developing a Map Reduce application, unit tests with MR unit, test data and local tests, anatomy of a Map Reduce job run, failures, job scheduling, shuffle and sort, task execution, Map Reduce types, input formats, output formats, Map Reduce features, Real-world Map Reduce	08
III	HDFS (Hadoop Distributed File System): Design of HDFS, HDFS concepts, benefits and challenges, file sizes, block sizes and block abstraction in HDFS, data replication, how does HDFS store, read, and write files, Java interfaces to HDFS, command line interface, Hadoop file system interfaces, data flow, data ingest with Flume and Scoop, Hadoop archives, Hadoop I/O: compression, serialization, Avro and file-based data structures. Hadoop Environment: Setting up a Hadoop cluster, cluster specification, cluster setup and installation, Hadoop configuration, security in Hadoop, administering Hadoop, HDFS monitoring & maintenance, Hadoop benchmarks, Hadoop in the cloud	08
IV	Hadoop Eco System and YARN: Hadoop ecosystem components, schedulers, fair and capacity, Hadoop 2.0 New Features - NameNode high availability, HDFS federation, MRv2, YARN, Running MRv1 in YARN. NoSQL Databases: Introduction to NoSQL MongoDB: Introduction, data types, creating, updating and deleting documents, querying, introduction to indexing, capped collections Spark: Installing spark, spark applications, jobs, stages and tasks, Resilient Distributed Databases, anatomy of a Spark job run, Spark on YARN SCALA: Introduction, classes and objects, basic types and operators, built-in control structures, functions and closures, inheritance.	09

V	Hadoop Eco System Frameworks: Applications on Big Data using Pig, Hive and HBase Pig - Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators,	09
	Hive - Apache Hive architecture and installation, Hive shell, Hive services, Hive metastore, comparison with traditional databases, HiveQL, tables, querying data and user defined functions, sorting and aggregating, Map Reduce scripts, joins & subqueries. HBase – Hbase concepts, clients, example, Hbase vs RDBMS, advanced usage, schema design, advance indexing, Zookeeper – how it helps in monitoring a cluster, how to build applications with Zookeeper. IBM Big Data strategy, introduction to Infosphere, BigInsights and Big Sheets, introduction to Big SQL.	

Reference books:

1. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley,2013
2. Dirk deRoos, Chris Eaton, George Lapis, Paul Zikopoulos, Tom Deutsch, “Understanding Big Data Analytics for Enterprise Class Hadoop and Streaming Data”, McGrawHill,2017
3. Thomas Erl, Wajid Khattak, Paul Buhler, “Big Data Fundamentals: Concepts, Drivers and Techniques”, Prentice Hall,2016
4. Bart Baesens “Analytics in a Big Data World: The Essential Guide to Data Science and its Applications”, John Wiley & Sons,2014
5. Arshdeep Bahga, Vijay Madisetti, “Big Data Science & Analytics: A HandsOn Approach “, VPT,2018
6. Tom White, "Hadoop: The Definitive Guide", O'Reilly,2012
7. Eric Sammer, "Hadoop Operations", O'Reilly,2012
8. Deepak Vohra, “Practical Hadoop Ecosystem: A Definitive Guide to Hadoop-Related Frameworks and Tools”, Apress,2016
9. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilly,2012
10. Lars George, "HBase: The Definitive Guide", O'Reilly,2012

IOE085 Natural Language Processing		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able :		
CO 1	To learn the fundamentals of natural language processing	K ₁ , K ₂
CO 2	To understand the use of CFG and PCFG in NLP	K ₁ , K ₂
CO 3	To understand the role of semantics of sentences and pragmatic	K ₂
CO 4	To Introduce Speech Production And Related Parameters Of Speech.	K ₁ , K ₂
CO 5	To Show The Computation And Use Of Techniques Such As Short Time Fourier Transform, Linear Predictive Coefficients And Other Coefficients In The Analysis Of Speech.	K ₃ , K ₄
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lecture
I	INTRODUCTION: Origins and challenges of NLP – Language Modeling: 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 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.	08
II	SYNTACTIC ANALYSIS: Context Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs – Feature structures, Unification of feature structures.	08
III	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, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.	08
IV	BASIC CONCEPTS of Speech Processing : Speech Fundamentals: Articulatory Phonetics – Production And Classification Of Speech Sounds; Acoustic Phonetics – Acoustics Of Speech Production; Review Of Digital Signal Processing Concepts; Short-Time Fourier Transform, Filter-Bank And LPC Methods.	08
V	SPEECH-ANALYSIS: Features, Feature Extraction And Pattern Comparison Techniques: Speech Distortion Measures– Mathematical And Perceptual – Log–Spectral Distance, Cepstral Distances,	08
	Weighted Cepstral Distances And Filtering, Likelihood Distortions, Spectral Distortion Using A Warped Frequency Scale, LPC, PLP And MFCC Coefficients, Time Alignment And Normalization – Dynamic Time Warping, Multiple Time – Alignment Paths. SPEECH MODELING : Hidden Markov Models: Markov Processes, HMMs – Evaluation, Optimal State Sequence – Viterbi Search, Baum-Welch Parameter Re-Estimation, Implementation Issues.	

Reference books:

1. Daniel Jurafsky, James H. Martin, “Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech”, Pearson Publication, 2014
2. Steven Bird, Ewan Klein and Edward Loper, “Natural Language Processing with Python”, First Edition, OReilly Media, 2009
3. Lawrence Rabiner And Biing-Hwang Juang, “Fundamentals Of Speech Recognition”, Pearson Education, 2003.
4. Daniel Jurafsky And James H Martin, “Speech And Language Processing: An Introduction To Natural Language Processing, Computational Linguistics, And Speech Recognition”, Pearson Education, 2002
5. Frederick Jelinek, “Statistical Methods Of Speech Recognition”, MIT Press, 1997
6. Breck Baldwin, “Language Processing with Java and LingPipe Cookbook”, Atlantic Publisher, 2015
7. Richard M Reese, “Natural Language Processing with Java”, OReilly Media, 2015
8. Nitin Indurkha and Fred J. Damerau, “Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press”, 2010
9. Tanveer Siddiqui, U.S. Tiwary, “Natural Language Processing and Information Retrieval, Oxford University Press”, 2008