

**GURU NANAK INSTITUTIONS TECHNICAL CAMPUS (AUTONOMOUS)**  
**SCHOOL OF ENGINEERING & TECHNOLOGY**  
**DEPARTMENT OF ARTIFICIAL INTELLIGENCE & DATA SCIENCE**  
**COURSE STRUCTURE**

**(Applicable for the Batch admitted from 2021-2022)**

**IV YEAR II SEM**

<b>S. No.</b>	<b>Subject Code</b>	<b>Subject</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
1		Organizational Behaviour	3	0	0	3
2		Professional Elective – VI	3	0	0	3
3		Open Elective-IV	3	0	0	3
4		Constitution of India	2	0	0	0
5		Technical Seminar	0	0	2	1
6		Main Project	0	0	14	7
<b>Total Credits</b>				<b>11</b>	<b>0</b>	<b>16</b>
						<b>17</b>

**L** – Lecture

**T** – Tutorial

**P** – Practical



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**Professional Elective – IV:**

1. Quantum Computing
2. Expert Systems
3. Cloud Computing

**Professional Elective – V:**

1. Social Network Analysis
2. Federated Machine Learning
3. Augmented Reality & Virtual Reality

**Professional Elective – VI:**

1. Speech and Video Processing
2. Robotic Process Automation
3. Cognitive Computing

**List of Open Electives:**

1. Introduction to Natural Language Processing
2. AI Applications
3. Introduction to Data Structures
4. Introduction to Database Management System

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**B.Tech. IV Year II Sem.**

**L T P C**  
**3 0 0 3**

**SPEECH AND VIDEO PROCESSING**  
**(PROFESSIONAL ELECTIVE – VI)**

**Course Objectives:**

Knowledge on speech and video processing techniques

**SYLLABUS:**

**UNIT - I:**

**Speech processing concepts:** The speech production mechanism, Discrete time speech signals, Pole-Zero modeling of speech, relevant properties of the fast Fourier transform for speech recognition, convolution, linear and nonlinear filter banks, spectral estimation of speech using DFT. Linear Prediction analysis of speech.

**UNIT - II:**

**Speech recognition:** Real and Complex Cepstrum, application of cepstral analysis to speech signal, feature extraction for speech, static and dynamic feature for speech recognition, robustness issues, discrimination in the feature space, feature selection, MFCC, LPCC, Distance measures, vector quantization models. Gaussian Mixture model, HMM.

**UNIT - III:**

**Basics of Video Processing:** Video formation, perception and representation: Principle of color video, video cameras, video display, pinhole model, CAHV model, Camera motion, Shape model, motion model, Scene model, two-dimensional motion models. Three-Dimensional Rigid Motion, Approximation of projective mapping.

**UNIT - IV:**

**Motion estimation Techniques:** Optical flow, motion representation, motion estimation criteria, optimization methods, pixel-based motion estimation, Block matching algorithm, gradient Based, Intensity matching, feature matching, frequency domain motion estimation, Depth from motion. Motion analysis applications: Video Summarization, video surveillance.

**UNIT - V:**

**object tracking and segmentation:** 2D and 3D video tracking, blob tracking, kernel based counter tracking, feature matching, filtering Mosaicing, video segmentation, mean shift based, active shape model, video shot boundary detection. Interframe compression, Motion compensation

**TEXT BOOKS:**

1. Fundamentals of Speech recognition – L. Rabiner and B. Juang, Prentice Hall signal processing series.
2. Digital Video processing, A Murat Tekalp, Prentice Hall.
3. Discrete-time speech signal processing: principles and practice, Thomas F. Quatieri, Coth.
4. Video Processing and Communications, Yao Wang, J. Osternann and Qin Zhang, Pearson Education.

**REFERENCE BOOKS:**

1. "Speech and Audio Signal Processing", B.Gold and N. Morgan, Wiley.
2. "Digital image sequence processing, Compression, and analysis", Todd R. Reed, CRC Press
3. "Handbook of Image and Video processing", Al Bovik, Academic press, second Edition

**COURSE OUTCOMES:**

1. Describe the mechanisms of human speech production systems and methods for speech feature extraction.
2. Understand basic algorithms of speech analysis and speech recognition.
3. Explain basic techniques in digital video processing, including imaging characteristics and sensors.
4. Apply motion estimation and object tracking algorithms on video sequence.



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**ROBOTIC PROCESS AUTOMATION**  
**(PROFESSIONAL ELECTIVE – VI)**

**COURSE OBJECTIVES:**

Aim of the course is to make learners familiar with the concepts of Robotic Process Automation

**SYLLABUS:**

**UNIT - I**

Introduction to Robotic Process Automation & Bot Creation Introduction to RPA and Use cases – Automation Anywhere Enterprise Platform – Advanced features and capabilities – Ways to create Bots.

**UNIT - II**

Web Control Room and Client Introduction - Features Panel - Dashboard (Home, Bots, Devices, Audit, Workload, Insights) - Features Panel – Activity (View Tasks in Progress and Scheduled Tasks) - Bots (View Bots Uploaded and Credentials).

**UNIT - III**

Devices (View Development and Runtime Clients and Device Pools) - Workload (Queues and SLA Calculator) - Audit Log (View Activities Logged which are associated with Web CR) - Administration (Configure Settings, Users, Roles, License and Migration) - Demo of Exposed API's – Conclusion – Client introduction and Conclusion.

**UNIT - IV**

Bot Creator Introduction – Recorders – Smart Recorders – Web Recorders – Screen Recorders - Task Editor – Variables - Command Library – Loop Command – Excel Command – Database Command - String Operation Command - XML Command.

**UNIT - V**

Terminal Emulator Command - PDF Integration Command - FTP Command - PGP Command - Object Cloning Command - Error Handling Command - Manage Windows Control Command - Workflow Designer - Report Designer.

**TEXT BOOKS:**

1. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath: Create Software robots. with the leading RPA tool – UiPath Kindle Edition.

**REFERENCES:**

1. Robotic Process Automation A Complete Guide - 2020 Edition Kindle Edition.

**COURSE OUTCOMES:**

1. Describe RPA, where it can be applied and how it's implemented.
2. Identify and understand Web Control Room and Client Introduction.
3. Understand how to handle various devices and the workload.
4. Understand Bot creators, Web recorders and task editors.



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**COGNITIVE COMPUTING**  
**(Professional Elective – VI)**

**PRE-REQUISITE:**

1. Probability theory

**COURSE OBJECTIVES:**

1. To provide an understanding of the central challenges in realizing aspects of human cognition.
2. To provide a basic exposition to the goals and methods of human cognition.
3. To develop algorithms that use AI and machine learning along with human interaction and feedback to help humans make choices/decisions.
4. To support human reasoning by evaluating data in context and presenting relevant findings along with the evidence that justifies the answers.

**SYLLABUS:**

**UNIT - I**

**Introduction to Cognitive Science:** Understanding Cognition, IBM's Watson, Design for Human Cognition, Augmented Intelligence, Cognition Modeling Paradigms: Declarative/ logic-based computational cognitive modeling, connectionist models of cognition, Bayesian models of cognition, a dynamical systems approach to cognition.

**UNIT - II**

Cognitive Models of memory and language, computational models of episodic and semantic memory, modeling psycholinguistics.

**UNIT - III**

Cognitive Modeling: modeling the interaction of language, memory and learning, Modeling select aspects of cognition classical models of rationality, symbolic reasoning and decision making.

**UNIT - IV**

Formal models of inductive generalization, causality, categorization and similarity, the role of analogy in problem solving, Cognitive Development Child concept acquisition. Cognition and Artificial cognitive architectures such as ACT-R, SOAR, OpenCog, CopyCat, Memory Networks.

**UNIT - V**

DeepQA Architecture, Unstructured Information Management Architecture (UIMA), Structured Knowledge, Business Implications, Building Cognitive Applications, Application of Cognitive Computing and Systems.

**TEXT BOOKS:**

1. The Cambridge Handbook of Computational Psychology by Ron Sun (ed.), Cambridge University Press.
2. Formal Approaches in Categorization by Emmanuel M. Pothos, Andy J. Wills, Cambridge University Press.

**REFERENCE BOOKS:**

1. Judith S. Hurwitz, Marcia Kaufman, Adrian Bowles Cognitive Computing and Big Data Analytics, Wiley
2. Vijay V Raghavan, Venkat N. Gudivada, Venu Govindaraju, Cognitive Computing: Theory and Applications: Volume 35 (Handbook of Statistics), North Holland.

**COURSE OUTCOMES:**

1. Understand what cognitive computing is, and how it differs from traditional approaches.
2. Plan and use the primary tools associated with cognitive computing.
3. Plan and execute a project that leverages cognitive computing.
4. Understand and develop the business implications of cognitive computing.



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**COURSE STRUCTURE**  
**(Applicable for the Batch admitted from 2021-2022)**

**INTRODUCTION TO NATURAL LANGUAGE PROCESSING (Open Elective - III)**

**B.Tech. IV Year I Sem.**

**L T P C**  
**3 0 0 3**

**Prerequisites:** Data structures, Finite Automata and Probability Theory.

**Course Objectives:**

- Introduction to some of the problems and solutions of NLP and their relation to linguistics and statistics.

**UNIT - I**

**Finding the Structure of Words:** Words and Their Components, Issues and Challenges, Morphological Models.

**Finding the Structure of Documents:** Introduction, Methods, Complexity of the Approaches, and Performances of the Approaches.

**UNIT - II**

**Syntax Analysis:** Parsing Natural Language, Treebanks: A Data-Driven Approach to Syntax, Representation of Syntactic Structure, Parsing Algorithms.

**UNIT - III**

**Semantic Parsing:** Introduction, Semantic Interpretation, System Paradigms, Word Sense Systems.

**UNIT - IV**

Predicate-Argument Structure, Meaning Representation Systems.

**UNIT - V**

**Language Modeling:** Introduction, N-Gram Models, Language Model Evaluation, bayesian parameter estimation, Language Model Adaptation, Language Models-class based, variable length, bayesian topic based, Multilingual and Cross Lingual Language Modeling.

**TEXT BOOKS:**

1. Multilingual natural Language Processing Applications: From Theory to Practice – Daniel M. Bikel and Imed Zitouni, Pearson Publication

**REFERENCE BOOKS:**

1. Speech and Natural Language Processing - Daniel Jurafsky & James H Martin, Pearson Publications
2. Natural Language Processing and Information Retrieval: Tanvier Siddiqui, U.S. Tiwary

**COURSE OUTCOMES:**

- Show sensitivity to linguistic phenomena and an ability to model them with formal grammars.
- Understand and carry out proper experimental methodology for training and evaluating empirical NLP systems
- Able to manipulate probabilities, construct statistical models over strings and trees, and estimate parameters using supervised and unsupervised training methods.
- Able to design, implement, and analyze NLP algorithms Able to design different language modeling Techniques.
- Able to design different language modeling Techniques.

**(Applicable for the Batch admitted from 2021-2022)**

**AI APPLICATIONS (Open Elective - III)**

**B.Tech. IV Year I Sem.**

**L T P C**  
**3 0 0 3**

**Course Objectives:** To give deep knowledge of AI and how AI can be applied in various fields to make life easy.

**UNIT - I**

Linguistic aspects of natural language processing, A.I. And Quantum Computing, Applications of Artificial Intelligence (AI) in business.

**UNIT - II**

Emotion Recognition using human face and body language, AI based system to predict diseases early, Smart Investment analysis, AI in Sales and Customer Support.

**UNIT - III**

Robotic Processes Automation for supply chain management.

**UNIT - IV**

AI-Optimized Hardware, Digital Twin i.e. AI Modeling, Information Technology & Security using AI.

**UNIT - V**

Recent Topics in AI/ML: AI/ML in Smart solutions, AI/ML in Social Problems handling, Block chain and AI.

**TEXT BOOKS:**

1. Sameer Dhanrajani, AI and Analytics, Accelerating Business Decisions, John Wiley & Sons.
2. Artificial Intelligence in Practice: How 50 Successful Companies Used AI and Machine Learning to Solve Problems, Bernard Marr, Matt Ward, Wiley.

**REFERENCE BOOKS:**

1. Life 3.0: Being Human in the Age of Artificial Intelligence by Max Tegmark, 2018.
2. Homo Deus: A Brief History of Tomorrow by Yuval Noah Harari, 2017.

**COURSE OUTCOMES:** After completion of course, students would be able to:

- To correlate AI and solutions to modern problems.
- To decide when to use which type of AI technique.
- Understand Robotic Processes Automation

Analyze AI-Optimized Hardware



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**IV Year B.Tech. Sem-II**

**L T P C**  
**3 0 0 3**

**INTRODUCTION TO DATA STRUCTURES**  
**(Open Elective-IV)**

**Prerequisite:**

1. A course on "Programming for Problem Solving "

**Course Objectives:**

- Exploring basic data structures such as stacks and queues.
- Introduces a variety of data structures such as hash tables, search trees, tries, heaps, graphs.
- Introduces sorting and pattern matching algorithms

**Course Outcomes:**

- Ability to select the data structures that efficiently model the information in a problem.
- Ability to assess efficiency trade-offs among different data structure implementations or combinations.
- Implement and know the application of algorithms for sorting and pattern matching.
- Design programs using a variety of data structures, including hash tables, binary and general tree structures, search trees, tries, heaps, graphs, and AVL-trees.

**SYLLABUS:**

**UNIT - I**

Introduction to Data Structures, abstract data types, Linear list – singly linked list implementation, insertion, deletion and searching operations on linear list, Stacks-Operations, array and linked representations of stacks, stack applications, Queues-operations, array and linked representations.

**UNIT - II**

**Hash table representation:** hash functions, collision resolution-separate chaining, open addressing- linear probing, quadratic probing, double hashing, rehashing, extendible hashing.

**UNIT - III**

**Search Trees:** Binary Search Trees, Definition, Implementation, Operations-  
B. Tech-Artificial Intelligence & Data Science – GNITC

Searching, Insertion and Deletion, AVL Trees, Definition, Height of an AVL Tree, Operations – Insertion, Deletion and Searching.

#### **UNIT - IV**

**Searching:** Linear search, Binary Search.

**Sortings:** Insertion Sort, Selection Sort, Bubble Sort, Quick Sort, Heap Sort, Merge Sort.

#### **UNIT - V**

**Graphs:** Types of Graphs, Graph Implementation Methods. Graph Traversal Methods, Minimum Cost Spanning Trees: Prim's Alogrithm and Kruskal's Algorithm.

#### **TEXT BOOKS:**

1. Fundamentals of data structures in C, 2 nd edition, E.Horowitz, S.Sahni and Susan Anderson Freed, Universities Press.
2. Data structures using c – A.S.Tanenbaum, Y. Langsam, and M.J. Augenstein, PHI/pearson education.

#### **REFERENCE BOOKS:**

- 1.Data structures: A Pseudocode Approach with C, 2<sup>nd</sup> edition, R.F.Gilberg And B.A.Forouzan, Cengage Learning.
- 2.Introduction to data structures in c, 1/e Ashok Kamthane.



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**IV Year B.Tech. Sem-II**

**L T P C**  
**3 0 0 3**

**INTRODUCTION TO DATABASE MANAGEMENT SYSTEM**  
**(Open Elective -IV)**

**Prerequisites**

- A course on "Data Structures".

**Course Objectives:**

- To understand the basic concepts and the applications of database systems.
- To master the basics of SQL and construct queries using SQL.
- Topics include data models, database design, relational model, relational algebra, transaction control, concurrency control, storage structures and access techniques.

**SYLLABUS:**

**UNIT - I**

**Database System Applications:** A Historical Perspective, File Systems versus a DBMS, the Data Model, Structure of a DBMS

**Introduction to Database Design:** Database Design and ER Diagrams, Entities, Attributes, and Entity Sets, Relationships and Relationship Sets, Additional Features of the ER Model, Conceptual Design With the ER Model

**UNIT - II**

**Database system architecture:** Data Abstraction, Levels of Abstraction in a DBMS, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML), Integrity constraints, data manipulation operations.

**UNIT - III**

**SQL: Queries, Constraints, Triggers:** form of basic SQL query, UNION, INTERSECT, and EXCEPT, Nested Queries, aggregation operators, NULL values, complex integrity constraints in SQL, triggers and active data bases.

**UNIT - IV**

**Schema refinement:** Problems caused by redundancy, decompositions, problems related to decomposition, reasoning about functional dependencies, FIRST, SECOND, THIRD normal forms, BCNF, lossless join decomposition, multi-valued dependencies, FOURTH normal form, FIFTH normal form

## **UNIT – V**

Transaction Concept, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for serializability, Lock Based Protocols, Timestamp Based Protocols, Validation- Based Protocols.

### **TEXT BOOKS:**

1. Database Management Systems, Raghurama Krishnan, Johannes Gehrke, Tata Mc Graw Hill 3rd Edition
2. Database System Concepts, Silberschatz, Korth, Mc Graw hill, V edition.

### **REFERENCE BOOKS:**

1. Database Systems design, Implementation, and Management, Peter Rob & Carlos Coronel 7th Edition.
2. Fundamentals of Database Systems, Elmasri Navrate Pearson Education
3. Introduction to Database Systems, C.J.Date Pearson Education
4. Oracle for Professionals, The X Team, S.Shah and V. Shah, SPD.

### **COURSE OUTCOMES:**

By the end of the course, students will be able to:

**CO 1:** Describe the basic fundamentals of DBMS,

**CO 2:** database design and normal forms

**CO 3:** Identify the appropriate SQL commands for retrieval and management of data

**CO 4:** Analyze the schema refinement and normal forms

**CO 5:** Identify data models for relevant problems