POST GRADUATE DEPARTMENT OF COMPUTER SCIENCES

University of Kashmir, Srinagar-190006

NAAC Accredited Grade "A+"

NOTES

Minutes of the Departmental Committee Meeting held on 8th April, 2026

A Departmental Committee Meeting was held on 8th April, 2026 at 2:00 p.m under the Chairmanship of the Head of the Department in his office chamber and following were present.

1. Prof. Javaid Iqbal	Professor & Head	....in the Chair
2. Prof.M. Arif Wani	Professor	
3. Prof. Majid Zaman	Professor	
4. Dr. Manzoor Ahmad Chachoo	Scientist-D	
5. Dr. Sajad M. Khan	Scientist-C	
6. Dr. Sajid Yousuf Bhat	Sr. Assistant Professor	
7. Dr. Abid Sarwar	Sr. Assistant Professor	

The following issues were discussed

Item-I:

In light of an even dated letter, the Departmental Committeevetted and approved a revised entrance syllabus for Five-Year Integrated Master's Programme in DS & AI comprising of 15 units, which shall be effective from the year 2027 and onwards, and annexed as Annexure-I to these minutes.

Item-II:

The Departmental Committee framed Entrance syllabus for admission to 4th year of FYIMP in DS & AI programme, subject to availability of vacancies, leading to award of 2-year Master's Degree in DS & AI, annexed as Annexure-II to these minutes.

Item-III:

The Departmental Committee framed Entrance syllabus for admission to 5th year of FYIMP in DS & AI programme subject to availability of vacancies, leading to award of 1-year Master's Degree in DS & AI, annexed as Annexure-III to these minutes.

The meeting ended with a vote of thanks to the chair

Prof. Javaid Iqbal
HOD

Prof. M. Arif Wani
Professor

Prof. Majid Zaman
Professor

Dr. Manzoor Ah. Chachoo
Scientist-D

Dr. Sajad M. Khan
Scientist-C

Dr. Sajid Y. Bhat
Sr. Assistant Professor

Dr. Abid Sarwar
Sr. Assistant Professor

Post Graduate Department of Computer Sciences
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Prof. Javaid Iqbal
Head

Annexure-I to the Minutes of Departmental Committee Meetings held on 8th April, 2026

(Item-I)

Entrance Examination Syllabus for the year 2027 and onwards for 5-year Integrated Masters Programme in Data Science & Artificial Intelligence (FYIMP in DS & AI)

Note: There shall be sixty questions, each carrying one mark. Weightage to be given to each section is indicated in parentheses. Paper setters are required to set the required number of multiple-choice questions with only one correct or most appropriate answer, separately for each section, ensuring uniform representation of the entire syllabus.

Unit I: Logical Reasoning (04)

Analogies, Syllogisms, Statement and conclusions, Statement and arguments, Blood relations, Direction sense tests, Seating arrangement (linear and circular), Puzzles (based on arrangements, comparisons, etc.), Venn diagrams, Coding and decoding, Arithmetic number series.

Unit II: English Language and Comprehension (04)

Vocabulary, Spot the Error, filling in blanks with appropriate words, Synonyms/Homonyms, Antonyms, Spellings/Detecting misspelt words, Idioms & Phrases, One-word substitution, Active/Passive Voice of Verbs, Conversion into Direct/Indirect narration, Reading Comprehension.

Unit III: Sets, Relations and Functions (04)

Sets, Relations and Functions – Definition and types of sets, Operations on sets, Types of relations and functions, Domain, range, and codomain, Composite functions and inverse functions.

Unit IV: Calculus (04)

Limits and Continuity – Concept of limits and continuity of functions, Differentiation, Application of derivatives, Integration and Differential Equations.

Unit V: Statistics and Probability (04)

Probability concepts and statistical data handling, Conditional probability, Introduction to random variables and distributions. Data; Representation of data through graphs and diagrams, advantages of graphical presentation, and construction of bar charts, multiple bar diagrams, sub-divided bar charts, pie charts, histograms, frequency polygons, and cumulative frequency curves (ogives). Concept of central tendency and its measures including Mean, Median, Mode, Geometric Mean, and Harmonic Mean; computation of these measures for discrete and continuous data; essentials of a good average, along with merits and demerits of different measures of central tendency. Combined Mean and Weighted Mean.

Unit VI: Algebra (04)

Quadratic equations and roots, Sequences and series, Matrices and determinants – properties and applications.

Unit VII: Computer Networks (04)

Types of networks – LAN, MAN, WAN, PAN, and other network types, Topologies and network structures. Basics of IP addressing, Overview of the Internet and web communication, Web browsers and their functions, Email, messaging, and other online communication tools.

Unit VIII: Programming Concepts (04)

Basic programming concepts and introduction to algorithms, Data types, Control structures (if, for, while), Functions, Recursion.

Unit IX: Data Structures and Data Handling (04)

Data types/objects/structures, Data structures and its types, Representation and implementation. Linear Data Structures: Array representation, operations, applications and limitations of linear arrays, 2-dimensional arrays, matrices, common operations of matrices, special matrices, array representation of Sparse matrices. One dimensional array: Traversal, Searching (Linear search, Binary search, Sorting (Bubble sort). Stack: Definition of a stack, Operations on stack (Push and Pop). Queue: Definition of a queue, Operations on queue (Enqueue and Dequeue)

Unit X: Boolean Algebra (04)

Boolean algebra and logic gates – Basics of Boolean algebra, Common logic gates (AND, OR, NOT, XOR), Simple circuit design and truth tables.

Unit XI: Object-Oriented Programming basics (04)

Introduction to Object Oriented Programming, Comparison of Procedural Programming and OOP, Benefits of OOP, Abstraction, Encapsulation, Inheritance, Polymorphism, Difference between C and C++.
Elements of C++ Language: Tokens and identifiers, Variables and Constants, Reference variables, Basic data types in C++, Streams in C++. Types of operators in C++. Decision and Control Structures: if statement, if-else statement, switch statement, Loop: while, do-while, for. Break and continue.

Unit XII: Operating System Basics (04)

Operating System, Types of Operating System: Batch Operating System Multitasking/Time Sharing, Operating System, Multiprocessing Operating System, Real Time Operating System, Distributed Operating System, Network Operating System, Mobile Operating System. Functions of Operating System: Processor Management, Memory Management, File Management, Device Management. 32-Bit and 64-Bit Operating System. Introduction to Firmware. Introduction to Microsoft Windows Operating System, Features of Windows Operating System, Versions of Windows Operating System, File structure of Windows Operating System.
Introduction: Goals & Structure of Operating System, Basic functions & Modes, Types of Operating System (Batch, Multiprogramming, Multitasking, Time Sharing, Parallel, Distributed & Real-Time O.S.), Windows, Android, macOS, Linux, GUI, Kernel.

Unit XIII: Python Programming Basics (04)

Introduction to Python: Overview of features, history, and applications in web development, data science, and automation, Basic Syntax, Variables & Data Types, Operators.

Unit XIV: Computer Fundamentals (04)

Number system, Logic Gates: Binary, Octal, Decimal, Hexadecimal; Conversion of Number System; Binary Arithmetic, Complement. Data Representation: positive, negative, maximum and minimum number representation, real number representation, underflow, overflow, range and accuracy of numbers.

Unit XV: Introduction to Emerging Technologies (04)

Big Data, Artificial Intelligence, Machine Learning, Natural Language Processing, Immersive Technologies (Augmented Reality, Virtual Reality), Robotics, Internet of Things (IoT), Cloud Computing and Types of Cloud Services.

Prof. Javaid Iqbal
Head

Annexure-II to the Minutes of Departmental Committee Meetings held on 8th April, 2026 (Item-II)

Entrance Examination Syllabus for the year 2027 and onwards for Admission to 4th Year of FYIMP in DS & AI (2-year Master's Programme in DS & AI)

Note: There shall be sixty questions, each carrying one mark. Weightage to be given to each section is indicated in parentheses. Paper setters are required to set the required number of multiple-choice questions with only one correct or most appropriate answer, separately for each section, ensuring uniform representation of the entire syllabus.

Unit I: Problem Solving with C (04)

Introduction to Problem Solving through programs, Overview of C programming language. Setting up the Development Environment. Flowcharts/Pseudocodes, the compilation process, Introduction to Syntax and Semantic errors. Writing and running a basic C program.

Variables and Data Types. Arithmetic expressions, Relational Operations, Logical expressions; Control Structures. Defining and calling functions. Recursion. 2-D arrays, Character Arrays and Strings. Basics of pointers. Dynamic memory allocation. Definition and use of structures.

Unit II: Python Programming (04)

overview of Python and its applications such as web development, data science, and automation, along with setting up the Python environment using tools like Anaconda and Jupyter Notebook. Python variables, basic operators, and the concept of blocks defined through indentation. Data types including numeric types (int, float, complex) and strings, along with string operations, program flow control using conditional statements such as if, elif, and else, and looping constructs including for loops with range and while loops. Data structures like lists, tuples, sets, and dictionaries, loop control statements such as break, continue, pass, and else. Programs using conditional statements, loops, and data structures in Python.

Unit III: Data Science (04)

Introduction to Data Science. Workflow of Data Science. Tools and Programming Languages. Data Sources and Formats. Data Science Process. Data collection methods- Data cleaning and pre-processing. Data exploration. Data modeling. Data distribution analysis. Basic tools (plots, graphs and summary statistics) of EDA. Introduction to Big Data. Steps in Big Data. Feature Engineering. General techniques for handling large data, missing data.

Unit IV: Data Structures using C (04)

Fundamental concepts of data structures including data types, objects, and structures, along with their representation and implementation. Linear data structures: arrays, their representation, operations, applications, and limitations. Searching techniques such as linear search and binary search, and sorting techniques: selection sort, insertion sort, bubble sort, quick sort, and merge sort. Two-dimensional arrays and matrices: operations, special matrices, and the array representation of sparse matrices. Linked lists: representation, types, and operations. Stack and queue data structures: their representation, basic operations, and implementation using arrays and linked lists. Applications of stacks such as parenthesis checking, infix to postfix conversion, postfix expression evaluation, and recursion implementation using stacks. Queue: simple queues, circular queues, deque, and priority queues.

Unit V: Algorithms Design & Analysis (04)

Introduction to Algorithms, Analysis of Algorithms, Growth of functions, Asymptotic Notations (Big-O, Big-Omega, Big-Theta), Complexity Analysis Techniques (Substitution method, Recursion Tree),Masters Theorem. Tower of Hanoi problem and its complexity. Search Algorithms (Linear Search, Binary Search), Sorting Algorithms (Selection Sort, Insertion Sort, Bubble Sort, Quick Sort, Merge Sort). Time complexity analysis of searching and Sorting algorithms.

Unit VI: Linear Algebra (04)

Scalars, Vectors, and Matrices: Definitions, notation, and basic, operations. Matrix operations: Addition, scalar multiplication, matrix multiplication, and transposition. Systems of linear equations: Row reduction, echelon forms, and Gaussian elimination. Determinants and Matrix Inverses: Definition and properties of determinants, Computation of determinants and matrix inverses. Application: Solving linear systems using inverses. Definitions: Formal definitions of vector spaces and subspaces. Linear Combinations and Span: Understanding the span of vectors and its significance. Basis and Dimension: Defining the basis of a vector space and exploring the concept of dimension. Rank-Nullity Theorem. Row space, column space, and null space of a matrix.

Unit VII: Artificial Intelligence (04)

Introduction and historical perspective, Artificial Intelligence-disciplines and applications, Types of AI, Theories of intelligence, Detecting and Measuring Intelligence, Turing Test, Future of AI Intelligent agent: Agent and Environments, nature of Environments, structure of Agent, Concept of Rationality, Search Strategies: Uninformed search strategies-Breadthfirst search, uniform cost search, Depthfirst search, Depth Limited and Iterative Deepening Search. Search with partial information (Heuristic Search), greedy best-first search, A* search, heuristic functions. Local Search Algorithm: Hill climbing, gradient descent, genetic algorithm. Knowledge Representation: Propositional logic, first-order logic, inference in first-order logic, propositional versus first-order logic.

Unit VIII: DBMS (04)

Introduction to Databases: Purpose of Database Systems, Components of DataBase Systems, Applications of Database Management Systems, Three Tier Database Management System Architecture, Data Independence, Database Schema, Instance, Data Modelling, Entity Relationship Model, Relational Model. Data integrity Rules, Functional Dependency, Normalization, First, Second, Third Normal Forms, BCNF, Multi-valued Dependencies, Pit-falls in relational Database design, De-normalization.

Unit IX: Evolutionary Computing (04)

Overview of Evolutionary Computing- Evolutionary Algorithms, Evolutionary Search Techniques, Principles of Genetic Algorithms, Encoding schemes and Representation. Selection, Crossover, and Mutation Operators. Evolutionary Strategies: Evolution in continuous variables. Transformations. Covariance Matrix Adaptation. Different Components of Evolutionary Algorithms- Framework, Populations, Selection operators, Genetic operators. Genetic Programming, Differential Evolution

Unit X: Probability Theory (04)

Probability: Sample space and events – Probability – The axioms of probability – addition law of probability – Conditional probability – Bayes' theorem. Counting Techniques: Permutations and combinations, applications in probability, discrete probability: finite and countably infinite sample spaces, inclusion-exclusion principle. Random Variables: Discrete and Continuous, Probability Mass Function (PMF), Probability Density Function (PDF), and Cumulative Distribution Function (CDF)– Distribution - Binomial, poisson.

Unit XI: Machine Learning (04)

Inductive learning algorithms. Categories of inductive learning algorithms. Rule extraction with inductive learning algorithms, Decision trees, ID3 algorithm. AQ algorithm, SAFARI algorithm Applications of Inductive Learning Machine Learning: Supervised, Unsupervised and Reinforcement Learning, Applications. Introduction to Classification: Overview, types of classification problems, binary vs. multi-class classification. Linear Regression, Logistic Regression.

Introduction to Clustering: Definition, types of clustering (hard vs. soft), applications, and importance.

K-Means and Variants: K-means algorithm, choosing the number of clusters (elbow method), K-means++.

Unit XII: Cloud Computing (04)

Cloud Computing definition, private, public and hybrid cloud. Cloud types; IaaS, PaaS, SaaS. Benefits and challenges of cloud computing, public vs private clouds, Business Agility: Benefits and challenges to Cloud architecture. VIRTUALIZATION: Role of virtualization in enabling the cloud: Types of Virtual Machines, Advantages of Virtualization, Components of Virtualization.

CLOUD APPLICATIONS: Technologies and the processes required when deploying web services; Deploying a web service from inside and outside a cloud architecture.

Unit XIII: Deep Learning Essentials (04)

Deep Learning vs. Traditional Machine Learning, Key Deep Learning Terminology, Shallow Architectures and Deep Architectures, Deep Learning Basics: Biological Neural Network, Artificial Neural Networks, Neuron as a basic building element of ANN, Activation Functions, Perceptron, learning with Perceptron, Limitations of Perceptron, Multilayer neural network, learning with Multilayer Perceptron, Training ANN using Backpropagation algorithm.

Bayesian Classifiers: Naive Bayes, assumptions, advantages, limitations, and Bayesian networks.

Support Vector Machines (SVM): SVM for linearly separable data, kernel methods for non-linearly separable data, hyperplane and margin concepts.

K-Nearest Neighbors (KNN): KNN algorithm, choice of K, distance metrics, and performance optimization.

Unit XIV: Digital Image Processing (04)

Introduction to Digital Image Processing, Origins of DIP, Examples, Fundamental steps in DIP, Components of DIP. Fundamental elements of visual perception: brightness, contrast, hue, saturation, Mach-band effect; Light and the electromagnetic spectrum. Image formation and digitization concepts; Image sensing and acquisition; Image sampling and quantization. Basic relationships between pixels: Neighbor's of pixel, adjacency, connectivity, regions and boundaries, distance measures.

Image enhancement in the spatial domain: Background; Point and arithmetic/logic operations; Some basic grey-level transformations; Histogram processing: Equalization, Matching.

Mechanics of spatial filtering: Correlation, Convolution; Smoothing spatial filters; Sharpening spatial filters.

Unit XV: Time Series Analysis & Forecasting (04)

Stochastic process. Time series as a discrete stochastic process. Main characteristics of stochastic processes-Auto-covariation and Autocorrelation functions. Stationary stochastic processes. Components of time series: trend, seasonality, cyclicity, and noise. Moving average (MA), Auto regressive (AR), ARMA and AR integrated MA (ARIMA) models. Box-Jenkins models, choice of AR and MA periods. Seasonal ARIMA models. Exponential Smoothing methods: Simple, Holt's, and Holt-Winters exponential smoothing

Prof. Javaid Iqbal
Head

Annexure-III to the Minutes of Departmental Committee Meetings held on 8th April, 2026

(Item-I)

Entrance Examination Syllabus for the year 2027 and onwards for Admission to 5th Year of FYIMP in DS & AI (1-year Master's Programme in DS & AI)

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Unit I: Evolutionary Computing

(04)

Overview of Evolutionary Computing- Evolutionary Algorithms, Evolutionary Search Techniques, Principles of Genetic Algorithms, Encoding schemes and Representation. Selection, Crossover, and Mutation Operators. Evolutionary Strategies: Evolution in continuous variables. Transformations. Covariance Matrix Adaptation. Different Components of Evolutionary Algorithms- Framework, Populations, Selection operators, Genetic operators. Genetic Programming, Differential Evolution

Unit II: Probability Theory

(04)

Probability: Sample space and events – Probability – The axioms of probability – addition law of probability – Conditional probability – Bayes' theorem. Counting Techniques: Permutations and combinations, applications in probability, discrete probability: finite and countably infinite sample spaces, inclusion-exclusion principle. Random Variables: Discrete and Continuous, Probability Mass Function (PMF), Probability Density Function (PDF), and Cumulative Distribution Function (CDF)– Distribution - Binomial, poisson.

Unit III: Machine Learning

(04)

Inductive learning algorithms. Categories of inductive learning algorithms. Rule extraction with inductive learning algorithms, Decision trees, ID3 algorithm. AQ algorithm, SAFARI algorithm Applications of Inductive Learning Machine Learning: Supervised, Unsupervised and Reinforcement Learning, Applications. Introduction to Classification: Overview, types of classification problems, binary vs. multi-class classification. Linear Regression, Logistic Regression.

Introduction to Clustering: Definition, types of clustering (hard vs. soft), applications, and importance. K-Means and Variants: K-means algorithm, choosing the number of clusters (elbow method), K-means++.

Unit IV: Cloud Computing

(04)

Cloud Computing definition, private, public and hybrid cloud. Cloud types; IaaS, PaaS, SaaS. Benefits and challenges of cloud computing, public vs private clouds, Business Agility: Benefits and challenges to Cloud architecture. VIRTUALIZATION: Role of virtualization in enabling the cloud: Types of Virtual Machines, Advantages of Virtualization, Components of Virtualization.

CLOUD APPLICATIONS: Technologies and the processes required when deploying web services; Deploying a web service from inside and outside a cloud architecture.

Unit V: Deep Learning Essentials

(04)

Deep Learning vs. Traditional Machine Learning, Key Deep Learning Terminology, Shallow Architectures and Deep Architectures, Deep Learning Basics: Biological Neural Network, Artificial Neural Networks, Neuron as a basic building element of ANN, Activation Functions, Perceptron, learning with Perceptron, Limitations of Perceptron, Multilayer neural network, learning with Multilayer Perceptron, Training ANN using Backpropagation algorithm.

Bayesian Classifiers: Naive Bayes, assumptions, advantages, limitations, and Bayesian networks.

,upport Vector Machines (SVM): SVM for linearly separable data, kernel methods for non-linearly separable data, hyperplane and margin concepts.
K-Nearest Neighbors (KNN): KNN algorithm, choice of K, distance metrics, and performance optimization. (04)

Unit VI: Digital Image Processing

Introduction to Digital Image Processing, Origins of DIP, Examples, Fundamental steps in DIP, Components of DIP. Fundamental elements of visual perception: brightness, contrast, hue, saturation, Mach-band effect; Light and the electromagnetic spectrum. Image formation and digitization concepts; Image sensing and acquisition; Image sampling and quantization. Basic relationships between pixels: Neighbor's of pixel, adjacency, connectivity, regions and boundaries, distance measures.
Image enhancement in the spatial domain: Background; Point and arithmetic/logic operations; Some basic grey-level transformations; Histogram processing: Equalization, Matching.
Mechanics of spatial filtering: Correlation, Convolution; Smoothing spatial filters; Sharpening spatial filters. (04)

Unit VII: Time Series Analysis & Forecasting

Stochastic process. Time series as a discrete stochastic process. Main characteristics of stochastic processes- Auto-covariation and Autocorrelation functions. Stationary stochastic processes. Components of time series: trend, seasonality, cyclicity, and noise. Moving average (MA), Auto regressive (AR), ARMA and AR integrated MA (ARIMA) models. Box-Jenkins models, choice of AR and MA periods. Seasonal ARIMA models. Exponential Smoothing methods: Simple, Holt's, and Holt-Winters exponential smoothing
Inheritance: Mechanism. Role of Access Modifiers. Method Overriding and Shadowing. Use of super keyword. Polymorphism Early and late binding. Abstract Class and Interface. Exception Handling: Mechanism - Exception-Object, Throwing an Exception, and Exception Handler. Types of Exception - Checked vs Unchecked, Built-in vs User defined. Catching an Exception try-catch-finally. Specifying an Exception throws.

Unit VIII: Optimization Techniques (04)

Linear Programming Problem (LPP): Formulating LPPs, Simplex Algorithm, Big-M Method, Two Phase Method, Sensitivity Problem. Duality in LPP: Duality Theorems, Dual Simplex Method.
Transportation Problems: Mathematical Formulation of Transportation problem, Methods of selecting initial basic feasible solution: Matrix minima method, North-West Corner Rule, Vogel's Approximation Method; Unbalanced Transportation Problem, Degeneracy in Transportation Problem and its resolution through MODI Method (U-V Method).

Unit IX: Deep Learning Architecture (04)

Convolutional Network Regularization: Data Augmentation, L2, Dropout, DropConnect. Batch Normalization, Transfer Learning and Fine-Tuning Pretrained Models. Advanced Convolutional Architectures: AlexNet, Visual Geometry Group, Residual Networks, Inception Networks: V1, V2, V3, V4 and Inception-Res, Applications of Convolutional Neural Network: Image classification, object detection, and image segmentation. Transfer Learning and Fine Tuning, Limitations of Convolutional Networks.
Overview of NAS: History and Motivation, significance in Deep Learning. Baseline methods and its limitations: Random and Grid search.

Unit X: Big Data Analytics (04)

Overview of Big Data: Definition, characteristics, and importance (Volume, Velocity, Variety, Veracity, and Value). Differences between traditional data management and Big Data. Challenges of Big Data. Introduction to Hadoop Ecosystem: HDFS, MapReduce. Introduction to NoSQL databases: Key-value stores, Document databases, Column-family stores.
Introduction to Hadoop: Architecture, HDFS (Hadoop Distributed File System), and MapReduce framework. Overview of Apache Spark: Architecture, RDD (Resilient Distributed Dataset), and comparison with MapReduce. Introduction to Data Warehousing: Hive, HBase. Introduction to Stream Processing: Apache Storm, Kafka.

Unit XI: Intrusion Detection Systems (04)

Overview of Intrusion detection and its importance in cybersecurity, Types of Intrusion Detection Systems. Attack trees and Correlation of Alerts, Autopsy of Worms and Botnets, Malware Detection, Obfuscation, Email/IM security issues, Viruses/ Spam, From Signatures to thumbprints to zero-day Detection, Insider Threat Issues, Masquerade and Impersonation Traitors, Decoys and Deception.
Basic concepts of Intrusion detection system and Intrusion Prevention System, Components of IDS: Sensors, analyzers, and user interfaces. Types of IDS: Host-based IDS (HIDS), Network-based IDS (NIDS), and Hybrid IDS.

Unit XII: Generative AI (04)

Introduction to Generative AI: What is Generative AI? Historical context and development. Applications of Generative AI. Generative vs. Discriminative Modeling. The rise of generative modeling, the generative modeling framework. Probability and Statistics in Generative AI, Probabilistic Generative Model. Naïve bayes. The challenges of Generative modeling.

Generative Models: Overview, Types of Generative Models (e.g., Variational Autoencoders, GANs, Boltzmann Machines). Strengths and Weaknesses of each model.

Unit XIII: Reinforcement Learning (04)

Overview of Reinforcement Learning (RL) and its applications. Differences between Supervised, Unsupervised, and Reinforcement Learning. Key concepts: Agent, Environment, Actions, Rewards, Policy, and Value Functions. The Markov Decision Process (MDP): states, actions, rewards, state transitions. Exploration vs. Exploitation dilemma.

Dynamic Programming: Policy Evaluation, Policy Iteration, and Value Iteration. Bellman Equations. Monte Carlo methods for prediction and control. Model-free vs. model-based RL. Exploration strategies: epsilon-greedy, softmax

Unit XIV: Natural Language Processing (04)

History and applications of NLP. Overview of NLP tasks and challenges. Text preprocessing: tokenization, stemming, lemmatization. Part-of-speech tagging and named entity recognition. Regular expressions and text pattern matching. Speech processing: Phonetics, speech sounds and phonetic transcription, phonological categories and pronunciation variation.

Text classification and sentiment analysis: Sequence labeling and parsing. Word embeddings. Feature Engineering for Text representation, Bag of Words model, Bag of N-Grams model, TF-IDF model. Named Entity Recognition (NER).

Unit XV: Fuzzy Systems (04)

History and evolution of fuzzy logic. Comparison between classical and fuzzy logic. Applications of fuzzy logic in various domains. Concept of fuzzy sets and membership functions. Operations on fuzzy sets: Union, Intersection, Complement. Types of membership functions: Triangular, Trapezoidal, And Gaussian. Fuzzy relations and their properties. Fuzzy logic operators: AND, OR, NOT.

Construction of fuzzy rules. Rule-based system design: Mamdani and Sugeno models. Fuzzification: Conversion of input data into fuzzy sets. Rule evaluation and aggregation. Defuzzification: Conversion of fuzzy outputs into crisp values. Design and implementation of fuzzy controllers.