SEMESTER –II

MACHINE LEARNING

1. Course Description

Programme:	**M.Sc. Computer Science (AI & ML)**	**Max. Hours: 60**
Course Code:	**P26/CAI/DSC/201**	**Hours per week: 4**
Course Type:	**DSC**	**Max. Marks: 100**
No. of credits:	**4**	

2. Course Objectives

- To understand the fundamental concepts of Machine learning.
- To study classification and regression models used for predictive analysis and performance evaluation.
- To understand advanced machine learning algorithms.
- To explore unsupervised learning techniques, including dimensionality reduction and clustering for pattern discovery in datasets.

3. Course Outcomes

On completion of the course, the student will be able to:

CO1: Apply data preprocessing techniques to prepare datasets for machine learning models. (L III)
CO2: Analyze and apply classification and regression models for prediction tasks. (LIV)
CO3: Analyze machine-learning algorithms such as SVM, Decision Trees, and ensemble methods. (LIV)
CO4: Apply dimensionality reduction and clustering techniques to analyze datasets. (LIII)

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University College of Engineering (A)
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4. Course Content

MODULE I:

Fundamentals of Machine Learning, Preparing the Data For Machine Learning Algorithms And Classification **15 Hours**

The Machine Learning Landscape- Introduction, examples, types of machine learning systems, main challenges, testing and validating; Prepare the Data for Machine Learning Algorithms-Data Cleaning, handling text and categorical attributes, custom transformers, feature scaling, transformation pipelines, training and evaluating on the training set; Classification- MNIST, training a binary classifier, performance measures, multiclass classification, error analysis, multilabel classification, multioutput classification.**Case Study: Classification model to recognize handwritten digits using the MNIST dataset.**

MODULE II:

Regression Models and Support Vector Machines **15 Hours**

Training Models- Linear Regression, gradient descent, polynomial regression, learning curves, regularized linear models, logistic regression. Support Vector Machines- Linear SVM classification, nonlinear SVM classification, SVM regression.**Case Study: House price prediction using Linear regression, Customer churn prediction using logistic regression, and Support Vector Machine (SVM) classifier to detect fraudulent credit card transactions.**

MODULE III:

Decision Trees, Ensemble Learning and Random Forests **15 Hours**

Decision Trees- Training and visualizing a decision tree, making predictions, estimating class probabilities, the CART training algorithm, computational complexity, Gini Impurity or Entropy, regularization hyperparameters, regression, instability; Ensemble Learning and Random Forests- voting classifiers, Bagging and Pasting, Random patches & random subspaces, random forests, Boosting, stacking.**Case Study: Medical diagnosis prediction, Product recommendation system.**

MODULE IV:

Dimensionality Reduction and Clustering **15 Hours**

Dimensionality Reduction- Introduction, main approaches for dimensionality reduction, PCA, kernel PCA, LLE, other dimensionality reduction techniques; Clustering, Gaussian mixtures.**Case Study: Image compression, Movie recommendation system.**

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5. References

1. Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems 2nd Edition , by AurélienGéron, O'reilly Media.
2. Machine Learning for Absolute Beginners, by Oliver Theobald, 2020.
3. Introduction to Machine Learning with Python, by Andreas C. Müller & Sarah Guido, O'Reilly Media.
4. Machine Learning by Subramanian, Chandra Mouli, Amit Kumar Das, Saikant
5. Dutt, Pearson Publications, I edition, 2018.
6. Machine Learning by Tom Mitchell, McGraw Hill, 2013.

6.Syllabus Focus

a) Relevance to Local, Regional, National and Global Development Needs

S.No	Local /Regional/National /Global Development Needs	Relevance
1	National Development	Machine Learning supports national development by enabling data-driven decision-making and industrial automation.
2	Global Development	Machine learning has the potential to address a wide range of global development needs by leveraging data- driven insights to inform decision-making and drive positive change across various sectors like agriculture, health, finance etc.

b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
SD	Modules I &II	Hands- on Practical's
EMP	Modules III&IV	Mini Project

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7. Pedagogy

S. No	Student Centric Methods Adopted	Type / Description of Activity
1.	Participative	Seminars
2.	Experimental	Practical demonstrations on ML techniques
3.	Problem solving	Programming assignments

8. Course Assessment Plan

a) Weightage of Marks in Continuous Internal Assessments and End Semester Examination

CO	Continuous Internal Assessments CIA - 40%	End Semester Examination- 60%
CO1	CIA 2 – Test 1: MCQ's, Quiz test or subjective	Written Exam
CO2	CIA 1 - Subjective	
CO3		
CO4	CIA 2 – Test 2: MCQ's or Presentation	

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b) Model Question Paper- End Semester Exam

MACHINE LEARNING

MODEL QUESTION PAPER THEORY

Course Code: P26/CAI/DSC/201 **Max Marks: 60**
Credits: 4 **Time: 2 ½ Hrs.**

I: Answer the following: **4x 10 = 40**

1. Define classification. Explain in detail about performance measures.

OR

2. Demonstrate on preparation of data for machine learning algorithm.
3. Describe in detail about linear regression.

OR

4. Compare and contrast linear SVM classification and nonlinear SVM classification.
5. Demonstrate in detail about visualization of decision tree by following the required steps.

OR

6. Explain in detail about bagging and boosting with example.
7. Explain in detail about principal component analysis.

OR

8. Define clustering. Explain k-means clustering with an example.

II: Answer any Four: **5 x 4 = 20**

9. Discuss about challenges of machine learning.
10. Describe in detail about error analysis.
11. Differentiate between batch and stochastic gradient descent.
12. Explain in detail about SVM regression.
13. Demonstrate manifold learning.
14. Describe in detail about DBSCAN.
15. Discuss about instability on decision trees.
16. Explain about Random Forests.

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University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

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Begumpet, Hyderabad-500 016.

Question Paper format – Blooms Taxonomy Level

SECTION A - INTERNAL CHOICE				**4Q X 10 M = 40 M**
Question Number	**Module Covered**	**Question**	**CO**	**BTL (Blooms Taxonomy Level)**
1	Module 1	Define classification. Explain in detail about performance measures.	CO 1	LI, LIII
2	Module 1	Demonstrate on preparation of data for machine learning algorithm.	CO 1	L III
3	Module 2	Describe in detail about linear regression.	CO 2	L II
4	Module 2	Compare and contrast linear SVM classification and nonlinear SVM classification.	CO 2	L IV
5	Module 3	Demonstrate in detail about visualization of decision tree by following the required steps.	CO 3	L III
6	Module 3	Explain in detail about bagging and boosting with example.	CO 3	LII
7	Module 4	Explain in detail about principal component analysis.	CO 4	L II
8	Module 4	Define clustering. Explain k-means clustering with an example.	CO 4	L I, L II
SECTION B - ANSWER ANY 5 OUT OF 8 (To compulsorily have ONE question from each module)				**5Q X 4 M = 20 M**
9	Module 1	Discuss about challenges of machine learning.	CO 1	L II
10	Module 1	Describe in detail about error analysis.	CO 1	L II
11	Module 2	Differentiate between batch and stochastic gradient descent.	CO 2	L IV
12	Module 2	Explain in detail about SVM regression.	CO 2	L II
13	Module 3	Demonstrate manifold learning.	CO 3	L III
14	Module 3	Describe in detail about DBSCAN.	CO 3	L II
15	Module 4	Discuss about instability on decision trees.	CO 4	L II
16	Module 4	Explain about Random Forests.	CO 4	L II

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c)Question Paper Blueprint

Modules	Hours Allotted in the Syllabus	CO Addressed	Section A (No. of Questions)	Total Marks	Section B (No. of Questions)	Total Marks
1	15	CO-1	2	4x10=40	8 (By taking two questions from each Module)	5x4=20
2	15	CO-2	2			
3	15	CO-3	2			
4	15	CO-4	2			

NOTE: From
Section-A any 4 questions can be answered (INTERNAL CHOICE).
Section-B any 5 questions can be answered. (EXTERNAL CHOICE)

9. CO-PO Mapping

CO	PO	Cognitive Level	Classroom sessions (hrs)
1	1,2	Apply	15
2	1,2	Analyze	15
3	1, 2	Analyze	15
4	1, 2	Apply	15

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Osmania University,
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SEMESTER II
MACHINE LEARNING PRACTICAL

1. Course Description

Programme: M.Sc. CSC (AI & ML)
Course Code: P26/CAI/DSC/201/P
Course Type: DSC
No. of credits: 2

Max. Hours: 60
Hours per week: 4
Max. Marks: 50

2. Course Objective

1. To explore various libraries and packages like NumPy, Matplotlib and Scikit-learn required for machine learning mechanisms.
2. To understand various types of supervised and unsupervised learning.

3. Course Outcomes

CO1: Applying Scikit-learn to represent data and model evaluation.
CO2: Exploring Supervised and UnSupervised learning algorithms for data analysis.

4. Course Content

1. Implementation of performance measures
    a. Cross-Validation
    b. Confusion matrix
    c. Precision and Recall
    d. ROC Curve
    - Develop a machine learning model to classify emails as spam or non-spam by applying text preprocessing, feature extraction, and classification algorithms. Evaluate the model using performance measures such as precision, recall, confusion matrix, and ROC curve.
    - Build a classification model to recognize handwritten digits using the MNIST dataset. Apply data preprocessing techniques and train binary and multiclass classifiers to evaluate prediction accuracy.
2. Supervised Learning:
    a. Linear Regression.
    b. Logistic Regression
    c. Support Vector Machines
    d. Building decision trees
    e. Bagging and Boosting

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Osmania University,
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- Design a machine learning model using linear regression to predict house prices based on features such as area, location, and number of rooms. Evaluate model performance using regression metrics.
- Develop a logistic regression model to predict whether customers are likely to discontinue a service based on usage data and customer attributes.
- Implement a Support Vector Machine (SVM) classifier to detect fraudulent credit card transactions by analyzing transaction patterns and identifying anomalies.

3. Un Supervised Learning:
   a. Transformation of data using Principal Component Analysis
   b. Applying k-Means Clustering
   c. Applying DBSCAN

- Use decision tree algorithms to predict diseases based on patient medical data and symptoms. Visualize the decision tree and interpret classification results.
- Develop a recommendation system using ensemble learning techniques such as Random Forest to recommend products based on user preferences and purchase history.
- Apply clustering algorithms such as k-means to group customers based on purchasing patterns and demographic features.
- Develop a recommendation system by analyzing user preferences and grouping similar users or movies using clustering techniques.
- Apply dimensionality reduction techniques using Principal Component Analysis (PCA) to reduce image data dimensions while preserving essential information.

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Osmania University,
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5. Model Question Paper

Machine Learning Practical

COURSE CODE: P26/CAI/DSC/201/P **Max.Marks: 50**

Exam Duration: 2 Hrs

Answer any one of the following.

1. Implement Cross-Validation using Model Evaluation.
2. Show the representation of data applying Linear Regression.
3. Implement k-means clustering using sample of data.
4. Transformation of data using Principal Component Analysis using Un Supervised Learning.
5. Applying DBSCAN using Data preprocessing.

Prepared by	Checked &Verified by	Approved by
Ms.Khalida Tabassum **Teaching Faculty**	**Dr. Sr. Sujatha Yeruva** **Head of the Department**	**Dr.Uma Joseph** **Principal**

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Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

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SEMESTER - II

DESIGN AND ANALYSIS OF ALGORITHMS

1. Course Description

Programme:	**M.Sc. Computer Science (AI & ML)**	**Max. Hours:**	**60**
Course Code:	**P26/CAI/ DSC/202**	**Hours per week:**	**4**
Type of Course:	**DSC**	**Max. Marks:**	**100**
No. of Credits:	**4**		

2. Course Objectives

- To understand and explain the functionality of algorithms.
- To Apply greedy approach to solve a fractional knapsack problem dynamic programming.
- To Analyzebasic graph and tree algorithms.
- To Explore and classify design and analysis techniques for NP-Hard and NP-Complete Problems

3. Course Outcomes

After the successful completion of the course, the student will be able to:

CO1: Understand and explain algorithms efficiency using asymptotic notations. (L I).

CO2: Analyze Greedy algorithm design techniques and dynamicprogramming. (LII)

CO3: Apply traversals techniques to find connected components in a graph c graph andtree algorithms. (L III)

CO4: Analyze the concepts of NP-hard problems. (L IV)

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4. Course Content

MODULE I: **15 Hours**

Introduction to Algorithms and Data structures

Introduction – Definition of an Algorithm, Algorithm Specification, Growth of Functions. Elementary Data Structures – Stacks and Queues, Trees, Dictionaries, Priority Queues, Graphs. Divide-and-Conquer –The master method for solving recurrences, Strassen's algorithm for Matrix Multiplication, Merge Sort, Quick Sort – Description and performance of Quick Sort. Heap sort.

MODULE II: **15 Hours**

Greedy Method and Dynamic Programming

Hash Tables, Binary Search Trees – Building, Querying, Inserting and Deleting in a Binary Search Tree. Red-Black Trees, B-Trees.

MODULE III: **15 Hours**

Graphs Traversal Techniques and Branch-Bound

Dynamic Programming – Elements of Dynamic Programming, Matrix-chain multiplication and Optimal Binary Search Trees as primary examples. Greedy Algorithms – Elements of greedy strategy, Activity-selection problem and Huffman codes as primary examples.

MODULE IV: **15 Hours**

Advanced Design and Analysis Techniques

Review of Fundamental Graph Algorithms, Minimum Spanning Trees – Kruskal and Prim, Single-Source Shortest Paths – Bellman-Ford and Dijkstra's algorithm. All-Pairs Shortest Paths – Floyd-Warshall algorithm. A brief Introduction to P and NP.

5. Reference Books

1. Cormen, T. (2009). Introduction to algorithms. Cambridge, Mass: MIT Press
2. E Horowitz, S Sahni, S Rajasekaran, (2007): Fundamentals of Computer Algorithms, 2/e, Universities Press.
3. T.H. Cormen, CE Leiserson, R.L Rivert, C Stein, (2010): Introduction to Algorithms,3/e, PHI.
4. R. Pannerselvam (2007): Design and Analysis of Algorithms, pHL
5. Hari Mohan Pandey, (2009): Design, Analysis and Algorithm, University Science press

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6. Syllabus Focus

a) Relevance to Local, Regional, National and Global Development Needs

S. No	Student Centric Methods Adopted	Type/Description of Activity
1.	National	Solve the graph problems based on exam patterns like **GATE/UGC-NET.**
2.	Global	Overall, the analysis of algorithms is essential for driving innovation, improving efficiency, ensuring accessibility, and addressing global challenges in various domains.

b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
Skill Development	Module I & II	Practical Hands-on.
Employability	Module III & IV	Strong skills in algorithms helps individuals identify skill gaps and align their career paths with job market demands.

7. Pedagogy

S. No	Student Centric Methods Adopted	Type / Description of Activity
1.	Participative Learning	Presentations
2.	Experiential Learning	Quiz
3.	Problem solving	Group discussions and skill activities

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8. Course Assessment Plan

a) Weightage of Marks in Continuous Internal Assessments and End Semester Examination

CO	Continuous Internal Assessments CIA -40%	End Semester Examination-60%
CO1	CIA 2 – Test 1: MCQ's, Quiz test or subjective	Written Exam
CO2	CIA 1 – Subjective	
CO3		
CO4	CIA 2 – Test 2: MCQ's or Presentation	

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b) Model Question Paper – End Semester Exam Theory

DESIGN AND ANALYSIS OF ALGORITHMS

Course Code: P26/ CAI/ DSC/202 **MAX MARKS: 60**
Credits: 4 **TIME: 2½Hours**

Note: This question paper consists of Section A and B. The answer to Section A & B must be written in the answer book given.

SECTION – A (Long Essay Type)

Answer ALL questions: **Marks: 4 x 10 =40**

1. Explain Strassens's algorithm for matrix multiplication.

OR

2. Describe Quick Sort algorithm illustrating with an example.
3. Explain Binary Search Tree in detail along with Tree traversals.

OR

4. Describe B-Trees and discuss the procedure to delete a key from it.
5. Describe Optimal Binary Search Trees.

OR

6. Explain Activity Selection problem.
7. Describe Floyd – Warshall algorithm for all pair shortest paths.

OR

8. Explain Dijkstra's algorithm for solving Single-Source Shortest Path.

SECTION –B (Short Essay Type)

II. Write short notes on any **FIVE** of the following: **Marks: 5 x 4 = 20**

9. Define Algorithm and discuss Aysmptotic notations.
10. Write a short note on Stacks and Queues.
11. Explain Hash tables and describe how collisions can be resolved.
12. Explain in brief about Red Black trees.
13. Explain Huffman Codes.
14. Discuss about elements of dynamic programming in brief.
15. Explain Breadth First Search.
16. Describe Kruskal's algorithm to find minimum cost spanning tree.

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Question Paper format – Blooms Taxonomy Level

SECTION A - INTERNAL CHOICE			4Q X 10 M = 40 M	
Question Number	**Module Covered**	**Question**	**CO**	**BTL (Blooms TaxonomyLevel)**
1	Module 1	Explain Strassens's algorithm for matrix multiplication.	CO 1	LI
2	Module 1	Describe Quick Sort algorithm illustrating with an example.	CO 2	L II
3	Module 2	Explain Binary Search Tree in detail along with Tree traversals.	CO 2	L I
4	Module 2	Describe B-Trees and discuss the procedure to delete a key from it.	CO 2	L II
5	Module 3	Describe Optimal Binary Search Trees.	CO 3	LII
6	Module 3	Explain Activity Selection problem.	CO 3	LIII
7	Module 4	Describe Floyd – Warshall algorithm for all pair shortest paths.	CO 4	L II
8	Module 4	Explain Dijkstra's algorithm for solving Single-Source Shortest Path.	CO 4	L IV

SECTION B - ANSWER ANY 5 OUT OF 8 (To compulsorily have ONE question from each module)			**4Q X 5 M = 20 M**	
9	Module 1	Define Algorithm and discuss Asymptotic notations.	CO 1	L I
10	Module 1	Write a short note on Stacks and Queues.	CO 1	L II
11	Module 2	Explain Hash tables and describe how collisions can be resolved.	CO 2	L I
12	Module 2	Explain in brief about Red Black trees.	CO 2	L II
13	Module 3	Explain Huffman Codes.	CO 3	L II
14	Module 3	Discuss about elements of dynamic programming in brief.	CO 3	L III
15	Module 4	Explain Breadth First Search.	CO 4	L II
16	Module 4	Describe Kruskal's algorithm to find minimum cost spanning tree.	CO 4	L IV

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c) Question Paper Blueprint

Modules	Hours Allotted in the Syllabus	CO Addressed	Section A (No. of Questions)	Total Marks	Section B (No. of Questions)	Total Marks
1	15	CO-1	2	4x10=40	8 (By taking two questions from each Module)	5x4=20
2	15	CO-2	2			
3	15	CO-3	2			
4	15	CO-4	2			

9. CO-PO Mapping

CO	PO	Cognitive Level	Classroom sessions (hrs)
1	1, 2	Understand	15
2	1,2	Apply	15
3	1, 2	Analyze	15
4	1, 4	Apply	15

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Hyderabad-500 007.

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DESIGN AND ANALYSIS OF ALGORITHMS

Practical Syllabus

1. Course Description

Programme:	**M.Sc. Computer Science (AI & ML)**	**Max. Hours:**	**40**
Course Code:	**P26/ CAI/ DSC/202/P**	**Hours per week:**	**2**
Type of Course:	**DSC**	**Max. Marks:**	**50**
No. of Credits:	**2**		

2. Course Objectives

1. To implement the efficientalgorithms and explain graphs.
2. Develop problem-solving and algorithmic skills.

3. Course Outcomes

After the successful completion of the course, the student will be able to:

CO1: Implement and execute tree, graph algorithms.
CO 2: Solve, optimize algorithms and dynamic programming.

4.Course Content

1. Implementation of Stack using Array (Push, Pop and Display operations).
2. Implementation of Queue using Arrays.
3. Program to demonstrate Merge Sort.
4. Program to demonstrate Quick Sort.
5. Program to demonstrate Heap Sort.
6. Program to create a Binary Search Tree and perform inorder traversal.
7. Program to create a Binary Search Tree and perform preorder traversal.
8. Program to create a Binary Search Tree and perform postorder traversal.
9. Program to construct and display a simple Graph.
10. Program to implement Breadth-first Search on aGraph.
11. Program to implement Depth-first Search on a Graph.
12. Program to implement Topological Sort on a Directed Graph.
13. Implement Dijkstra's algorithm to find a shortest path on a Directed Graph.
14. Implement Bellman-Ford algorithm to find a single source shortest path.
15. Program to implement a Hash Table.
16. Program to demonstrate Huffman codes.
17. Program to illustrate Activity Selection Problem

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5.Model Question Paper – End Semester Exam Practical

DESIGN AND ANALYSIS OF ALGORITHMS

Programme: M.Sc. Computer Science (AI & ML)
Course Code:P26/ CAI/ DSC/202/P
Type of Course: DSC **Max. Marks: 50**
No. of credits: 2

Answer any ONE of the Following

1. Write a Program to demonstrate Merge Sort.
2. Write a Program to create a Binary Search Tree and illustrate Tree Traversals on it.
3. Write a Program to implement Depth-first Search on a Graph.
4. Write a Program to implement Topological Sort on a Directed Graph.
5. Write a Program to illustrate Activity Selection Problem.

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Prepared by	Checked &Verified by	Approved by
Ms. Jyothi Reddy Teaching faculty	Dr. Sr. Sujatha Yeruva HoD	Prof. Uma Joseph Principal

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

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SEMESTER - II

NATURAL LANGUAGE PROCESSING

1. Course Description

Programme:	**M. Sc**	**Max. Hours:**	**60**
Course Code:	**P26/ CAI/ DSC/203**	**Hours per week:**	**4**
Type of Course:	**DSC**	**Max. Marks:**	**100**
No. of Credits:	**4**		

2. Course Objectives

- Understand fundamentals of NLP and text analytics.
- Apply Python to pre-process and transform text data.
- Analyze text to extract patterns and insights.
- Build Python applications for sentiment, topics, and visualization.

3. Course Outcomes

After the successful completion of the course, the student will be able to:

CO1: Interpret NLP and text processing techniques. **(Level II)**

CO2: Implement text pre-processing pipelines in Python. **(Level III)**

CO3: Perform sentiment analysis and topic modeling on datasets. **(Level IV)**

CO4: Develop end-to-end text analytics workflows with visualization. **(Level VI)**

4. Course content

MODULE I: **15 Hours**

Regular Expressions and Text Processing

Natural Language basics : Linguistics, language syntax and structure – words, phrases, clauses, grammar – dependency grammars, constituency grammars, word order typology; language semantics – lexical semantic relations, representation of semantics, Text Corpora – Corpora annotations and utilities, popular corpora, accessing text corpora, applications of natural language processing; Working with Text – String literals, string operations and methods, regular expressions, text analytics frameworks

Processing and Understanding Text: Text tokenization – sentence tokenization, work tokenization; Text normalization – cleaning text, tokenizing text, removing special characters, expanding contractions, case conversions, removing stopwords, correcting words, stemming, lemmatization.

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MODULE II: **15 Hours**

POS Tagging and Text Classification

Understanding text syntax and structure – installing necessary dependencies, importing machine language concepts, Parts of Speech (POS) tagging – recommended POS taggers, building POS taggers, shallow parsing, dependency-based parsing, constituency-based parsing

Text classification – automated text classification, text classification blueprint, text normalization, feature extraction – Bag of Words model, TF-IDF model, advanced word vectorization models – averaged word vectors, TF-IDF weighted average vector words, classification algorithms – multinomial Naïve Bayes, support vector machines, evaluating classification models, building a multi class classification system, applications and uses

MODULE III: **15 Hours**

Feature Extraction

Text Summarization: feature matrix, singular value decomposition, feature extraction, key phrase extraction – collocations, weighted tag-based phrase extraction, topic modelling – latent semantic indexing, latent Dirichlet allocation, non-negative matrix factorization, extracting topics from product reviews, automated document summarization – latent semantic analysis, TextRank, summarizing a product description

Text Similarity and Clustering: similarity measures, analyzing text similarity – Hamming distance, Manhattan distance, Euclidean distance, Levenshtein Edit distance, Cosine distance and similarity, analyzing document similarity – Cosine similarity, Hellinger – Bhattacharya distance, Okapi BM25 ranking, document clustering, clustering greatest movies of all time – K-means clustering, affinity propagation, Ward's Agglomerative Hierarchical clustering.

MODULE IV: **15 Hours**

Semantic and Sentiment Analysis

Semantic Analysis : Exploring WordNet – understanding Synsets, analyzing semantic relations – entailments, homonyms and homographs, synonyms and antonyms, hyponyms and hypernyms, holonyms and meronyms, semantic relationships and similarity, word sense disambiguation, named entity recognition, analyzing semantic representation – propositional logic, First Order logic, sentiment analysis, sentiment analysis of IMDb Movie reviews- setting up dependencies, preparing datasets, supervised machine learning technique, unsupervised Lexicon-based techniques - AFINN lexicon, Sent WordNet, VADER lexicon, Pattern lexicon

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Osmania University,
Hyderabad-500 007.

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5. Reference Books

1. Dipanjan Sarkar, Text Analytics with Python - A Practical Real-World Approach to Gaining Actionable Insights from your Data, Apress, 2016
2. Hobson Lane and Maria Dyshel, Natural Language Processing in Action, Second Edition, Manning, 2025
3. Steven Bird, Ewan Klein, and Edward Loper, Natural Language Processing with Python, O'Reilly, 2009
4. Daniel Jurafsky and James H. Martin, Speech and Language Processing - An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition with Language Models, Second Edition, Pearson, 2013

6. Syllabus Focus

a) Relevance to Local, Regional, National and Global Development Needs

S. No	Student Centric Methods Adopted	Type/Description of Activity
1.	National	Students will apply NLP techniques to Indian Knowledge System texts, including Sanskrit and regional literature, for pre-processing, POS tagging, and semantic analysis
2.	Global	Students will apply NLP techniques to global English corpora, such as IMDB reviews and Wikipedia, for classification, summarization, and sentiment analysis.

b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
Skill Development	Module I & II	Hands- on Practicals
Employability	Module III & IV	Text Summarization & Clustering Mini Project
Empowerment	Module I–IV	NLP on Indian Knowledge System & Global Corpora

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7. Pedagogy

S. No	Student Centric Methods Adopted	Type / Description of Activity
1.	Participative Learning	Presentations and Group Discussions on NLP concepts and Indian Knowledge System texts
2.	Experiential Learning	Hands-on Practicals using Python for tokenization, POS tagging, text classification, and feature extraction
3.	Problem solving	Mini Projects on text summarization, clustering, semantic analysis, and sentiment analysis

8. Course Assessment Plan

a) Weightage of Marks in Continuous Internal Assessments and End Semester Examination

<table>
<tr><th>CO</th><th>Continuous Internal Assessments CIA - 40%</th><th>End Semester Examination- 60%</th></tr>
<tr><td>CO1</td><td>CIA 2 – Test 1: MCQ’s, Quiz test or subjective</td><td rowspan="4">Written Exam</td></tr>
<tr><td>CO2</td><td rowspan="2">CIA 1 - Subjective</td></tr>
<tr><td>CO3</td></tr>
<tr><td>CO4</td><td>CIA 2 – Test 2: MCQ’s or Presentation</td></tr>
</table>

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b) Model Question Paper – End Semester Exam Theory

NATURAL LANGUAGE PROCESSING

Course Code: P26/ CAI/ DSC/203 **MAX MARKS: 60**
Credits: 4 **TIME: 2½ hours**

Note: This question paper consists of Section A and B. The answer to Section A & B must be written in the answer book given.

SECTION – A (Long Essay Type)

Answer ALL questions: **Marks: 4 x 10 = 40**

1. Explain the process of text normalization in NLP. Discuss its importance and list the typical steps involved.

OR

2. Define regular expressions and describe their role in text processing. Give two examples of patterns and explain what they match.

3. Compare dependency-based parsing and constituency-based parsing in NLP. Include examples of each.

OR

4. Explain the Bag-of-Words and TF-IDF models for text feature extraction. How are they used in text classification?

5. Explain Latent Dirichlet Allocation (LDA) and its application in topic modeling. Illustrate with a simple example.

OR

6 Discuss text similarity measures. Compare Cosine similarity and Euclidean distance in document analysis.

7. Explain semantic relationships in NLP such as synonyms, antonyms, hypernyms, and hyponyms. How does word sense disambiguation help in text understanding?

OR

8. Compare supervised and lexicon-based sentiment analysis methods. Give examples of when each approach is preferable.

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SECTION –B (Short Essay Type)

II. Write short notes on any **FIVE** of the following: **Marks: 4 x 5 = 20**

9. Define tokenization and explain its types in NLP.
10. Give two examples of string operations or methods in Python used for text pre-processing.
11. What is POS tagging? Name any two POS taggers.
12. Differentiate between Bag-of-Words and TF-IDF in one sentence each.
13. What is Latent Semantic Analysis (LSA)? Mention one application.
14. Name any two text similarity measures and briefly state when each is used.
15. What is a synonym and antonym? Give one example each.
16. Name any two lexicon-based sentiment analysis techniques used in NLP.

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Question Paper format – Blooms Taxonomy Level

SECTION A - INTERNAL CHOICE				**4Q X 10 M = 40 M**
Question Number	**Module Covered**	**Question**	**CO**	**BTL (Blooms Taxonomy Level)**
1	Module 1	Explain the process of text normalization in NLP. Discuss its importance and list the typical steps involved.	CO 1	Level II
2	Module 1	Define regular expressions and describe their role in text processing. Give two examples of patterns and explain what they match.	CO 1	Level III
3	Module 2	Compare dependency-based parsing and constituency-based parsing in NLP. Include examples of each.	CO 2	Level IV
4	Module 2	Explain the Bag-of-Words and TF-IDF models for text feature extraction. How are they used in text classification?	CO 2	Level VI
5	Module 3	Explain Latent Dirichlet Allocation (LDA) and its application in topic modeling. Illustrate with a simple example.	CO 3	Level II
6	Module 3	Discuss text similarity measures. Compare Cosine similarity and Euclidean distance in document analysis.	CO 3	Level III
7	Module 4	Explain semantic relationships in NLP such as synonyms, antonyms, hypernyms, and hyponyms. How does word sense disambiguation help in text understanding?	CO 4	Level IV
8	Module 4	Compare supervised and lexicon-based sentiment analysis methods. Give examples of when each approach is preferable.	CO 4	Level VI
SECTION B - ANSWER ANY 5 OUT OF 8 (To compulsorily have ONE question from each module)				**4Q X 5 M = 20 M**
9	Module 1	Define tokenization and explain its types in NLP.	CO 1	Level II
10	Module 1	Give two examples of string operations or methods in Python used for text pre-processing.	CO 1	Level III
11	Module 2	What is POS tagging? Name any two POS taggers.	CO 2	Level IV
12	Module 2	Differentiate between Bag-of-Words and TF-IDF in one sentence each.	CO 2	Level VI
13	Module 3	What is Latent Semantic Analysis (LSA)? Mention one application.	CO 3	Level II

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14	Module 3	Name any two text similarity measures and briefly state when each is used.	CO 3	Level III
15	Module 4	What is a synonym and antonym? Give one example each.	CO 4	Level IV
16	Module 4	Name any two lexicon-based sentiment analysis techniques used in NLP.	CO 4	Level VI

c) Question Paper Blueprint

Modules	Hours Allotted in the Syllabus	CO Addressed	Section A (No. of Questions)	Total Marks	Section B (No. of Questions)	Total Marks
1	15	CO-1	2	4x10=40	8 (By taking two questions from each Module)	5x4=20
2	15	CO-2	2			
3	15	CO-3	2			
4	15	CO-4	2			

9. CO-PO Mapping

CO	PO	Cognitive Level	Classroom sessions (hrs)
1	1, 2	Analyze	15
2	1,2	Apply	15
3	1, 2	Analyze	15
4	1, 4	Apply	15

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NATURAL LANGUAGE PROCESSING
Practical Syllabus

1. Course Description

Programme:	**M. Sc**	**Max. Hours:**	**40**
Course Code:	**P26/ CAI/ DSC/203/P**	**Hours per week:**	**2**
Type of Course:	**DSC**	**Max. Marks:**	**50**
No. of Credits:	**2**		

2. Course Objectives

1. Develop practical NLP skills using Python.
2. Apply NLP to Indian and global text datasets.

3. Course Outcomes

After the successful completion of the course, the student will be able to:

CO1: Pre-process and analyze text data effectively.

CO 2: Build end-to-end NLP pipelines for real-world tasks.

4. Course Content

Regular Expressions and Text Processing

1. Social Media Text Preprocessing: Clean and normalize Instagram captions and comments (including hashtags, mentions, emojis, URLs), and perform tokenization, stopword removal, and lemmatization.
2. News Article Regex Extraction: Extract dates, names, locations, and email addresses from Instagram captions or comments using Python regex.
3. Multilingual Text Cleaning: Preprocess Hindi or Tamil Instagram captions, handling Sandhi, compound words, punctuation, and emojis.

   Suggested Datasets - Instagram captions/comments, Twitter tweets

POS Tagging and Text Classification

1. POS Tagging on Instagram Posts: Build a POS tagging pipeline for English and Indian language Instagram captions and analyze syntactic patterns.
2. Instagram Comment Classification: Classify comments into categories like positive, negative, or neutral using TF-IDF and Naïve Bayes.

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3. Hashtag-based Topic Classification: Use hashtags from Instagram posts to classify posts into categories such as travel, food, fashion, or fitness.

   Suggested Datasets - IMDb reviews, Amazon product reviews, BBC News

Feature Extraction

1. Topic Modeling on Instagram Captions: Apply LDA or NMF on captions from public Instagram pages to identify key topics or trends.
2. Text Summarization of Instagram Captions: Generate short summaries of multiple captions from a brand page or influencer account using TextRank or LSA.
3. Clustering Instagram Posts: Cluster Instagram captions or comments based on content similarity using Cosine similarity and K-Means clustering to find related post groups.

   Suggested Datasets - Wikipedia articles, Reddit comments, Amazon reviews

Semantic and Sentiment Analysis

1. Semantic Analysis of Instagram Text: Analyze synonyms, antonyms, hypernyms, and word senses in Instagram captions using WordNet and handle multilingual text.
2. Sentiment Analysis of Instagram Comments: Compare lexicon-based (VADER, SentWordNet) and supervised ML approaches to classify comment sentiments.
3. Named Entity Recognition on Instagram Posts: Extract entities like brands, locations, or influencers from Instagram captions and comments using NER libraries.

   Suggested Datasets - WordNet, VADER/SentWordNet, Instagram or IMDb comments

Mini-project on a case study of a chosen sample dataset (e.g., Instagram posts, comments, or any real-world text corpus).

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5. Model Question Paper – End Semester Exam Practical

NATURAL LANGUAGE PROCESSING

Programme : M.Sc.
Course Code : P26/ CAI/ DSC/203/P
Type of Course: DSC **Max. Marks: 50**
No. of credits : 2

Answer the following

- Implement end-to-end NLP tasks using Python and relevant libraries (NLTK, spaCy, Scikit-learn, Gensim, VADER, etc.).
- Demonstrate a mini-project case study using a sample dataset (e.g., Instagram posts/comments, IMDb reviews, or any real-world text corpus).

Prepared by	Checked &Verified by	Approved by
Ms. Padmashree Teaching faculty	Dr. Sr. Sujatha Yeruva HoD	Prof. Uma Joseph Principal

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SEMESTER - II

INFORMATION SECURITY

1. Course Description

Programme:	**M.Sc. Computer Science (AI & ML)**	**Max. Hours:**	**60**
Course Code:	**P26/CAI/ DSC/204**	**Hours per week:**	**4**
Type of Course:	**DSC**	**Max. Marks:**	**100**
No. of Credits:	**4**		

2. Course Objectives

- Understand fundamental concepts of information security and security threats.
- Study cryptographic techniques used to secure data and communication.
- Understand authentication, authorization and access control mechanisms.
- Learn security issues in databases, software and networks & understand security technologies such as IDS, firewalls.

3. Course Outcomes

After the successful completion of the course, the student will be able to:

1. **CO1:**Identify various threats, attacks in information systems and apply symmetric encryption.(L II)
2. **CO2:**Apply cryptographic techniques such as and asymmetric encryption.(L II)
3. **CO3:** Analyze authentication mechanisms and access control models. (L III)
4. **CO4:** Evaluate network attacks, malware and firewall technologies. (L IV)

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4. Course Content

MODULE I: **15 Hours**

Overview, Symmetric Cipher

Introduction to Information Security: Computer Security concepts, Attacks, Security services, Security mechanisms; Classical Encryption Techniques: Symmetric Cipher Model, Substitution, Transposition Techniques, Block Ciphers and the Data Encryption Standard: Block cipher Principles, A DES Example, Data Encryption Standard (DES); Advanced Encryption Standard (AES): The origins AES, AES Structure, AES Round Functions, An AES Example.

MODULE II: **15 Hours**

Asymmetric Ciphers and Cryptographic Hash Functions

Public-Key Cryptography and RSA: Principles of Public-Key Cryptosystem, RSA Algorithm; Cryptographic Hash Functions: Applications of Cryptographic Hash Functions, Secure Hash functions (SHA).

MODULE III: **15 Hours**

Authentication, Access Control and Database Security

User Authentication: Means of Authentication, Password-based authentication, Token-based authentication, Biometric authentication, Remote user authentication; Security issues for user authentication; Access Control: Access control principles, Subjects and objects, Access rights, Discretionary Access Control (DAC), Role-Based Access Control (RBAC).Database Security: The need for the Database security, Database Management Systems, Database access control.

MODULE IV: **15 Hours**

Malicious Software, Denial of Service (DoS), Intrusion Detection (ID) and Firewalls

Malicious Software: Types of Malicious Software, Propagation Infected Content-Viruses, Propagation- Vulnerability Exploit- Worms, Propagation-Social Engineering-SPAM E-Mail, Trojans, Payload-System Corruption, Payload-Attack Agent-Zombie,Bots, Payload-Information Theft-Keyloggers, Phishing,Spyware, Payload-Stealthing-Backdoors, Rootkits, Countermeasures; Firewalls and Intrusion Prevention Systems: Need for firewalls, Firewall characteristics, Types of Firewalls (Packet filtering firewalls, Stateful inspection firewalls), Intrusion Prevention System.

5. Reference Books

1. William Stallings, W. (2017). *Cryptography and network security: Principles and practice* (Fifth edition). Pearson.(Module I)
2. W. Stallings, L. Brown, Computer Security: Principles and Practice, 2nd edition, Pearson Education. (Module II, III, IV)
3. Stallings W. Cryptography and network security, 7th edition, Pearson Education, 2018.
4. Pfleeger, C. P. & Pfleeger, S. L.(2015). *Security in computing* (5th ed.). Prentice Hall.
5. Godbole, N. (2013). *Information systems security*. Wiley India.

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Osmania University,
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6. Syllabus Focus

a) Relevance to Local, Regional, National and Global Development Needs

S. No	Student Centric Methods Adopted	Type/Description of Activity
1.	National	Solve the graph problems based on exam patterns like **GATE/UGC-NET.** Cryptography, authentication, and access control help secure banking, e-governance, and digital systems.
2.	Global	Security, Malware, DoS attacks, and firewalls address global cyber security threats and internet security issues.

b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
Skill Development	Module I & II	Learning cryptographic tools and authentication methods.
Employability	Module III & IV	Knowledge of malware, database security, and firewalls used in cyber security jobs.
Entrepreneurship Development	Module II & III	Understanding secure software and database protection for developing secure applications.

7. Pedagogy

S. No	Student Centric Methods Adopted	Type / Description of Activity
1.	Participative Learning	Presentations, group discussions
2.	Experiential Learning	Hands-on labs on cryptography, authentication and firewall configuration
3.	Problem solving	Case studies on security threats and attacks

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8. Course Assessment Plan

a) Weightage of Marks in Continuous Internal Assessments and End Semester Examination

CO	Continuous Internal Assessments CIA - 40%	End Semester Examination- 60%
CO1	CIA 2 – Test 1: MCQ's, Quiz test or subjective	Written Exam
CO2	CIA 1 – Subjective	
CO3		
CO4	CIA 2 – Test 2: MCQ's or Presentation	

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b) Model Question Paper – End Semester Exam Theory

INFORMATION SECURITY

Course Code: P26/CAI/DSC/204 **MAX MARKS: 60**
Credits: 4 **TIME: 2 ½ hours**

Note: This question paper consists of Section A and B. The answer to Section A & B must be written in the answer book given.

SECTION – A (Long Essay Type)

I. Answer All : **Marks: 4 x 10 = 40**

1. Explain the Security attacks and Security services in detail.

OR

2. Explain the symmetric Substitutional encryption technique with an example.
3. Explain the Public key Encryption in detail with the diagram.

OR

4. Explain RSA with an example.
5. Define User authentication. Discuss Password- Based Authentication, Biometric Authentication, in detail.

OR

6. Discuss the Need for Database Security in detail?

7. Explain the types of Malicious Software with an example for each.

OR

8. Define Firewall? Explain the types of Firewalls. Give examples for each.

SECTION –B (Short Essay Type)

II. Answer any **FIVE** of the following: **Marks: 5 x 4 = 20**

9. Discuss various types of security mechanisms.
10. Explain Confidentiality.
11. Explain the Applications of Cryptographic Hash Functions.
12. Explain SHA algorithm.
13. Explain the Access Control Principles.
14. Write a short note on Database Access Control.
15. Give an account on Payload-Stealthing-Backdoors.
16. Explain the Firewall Characteristics in detail.

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Question Paper format – Blooms Taxonomy Level

SECTION A - INTERNAL CHOICE			4Q X 10 M = 40 M	
Question Number	**Module Covered**	**Question**	**CO**	**BTL (Blooms Taxonomy Level)**
1	Module 1	Explain the Security attacks and Security services in detail.	CO 1	L II
2	Module 1	Explain the symmetric Substitutional encryption technique with an example.	CO 1	L II
3	Module 2	Explain the Public key Encryption in detail with the diagram.	CO 2	L I & II
4	Module 2	Explain RSA with an example.	CO 2	L I & II
5	Module 3	Define User authentication. Discuss Password- Based Authentication, Biometric Authentication, in detail.	CO 3	L II
6	Module 3	Discuss the Need for Database Security in detail.	CO 3	LIII
7	Module 4	Explain the types of Malicious Software with an example for each.	CO 4	LII
8	Module 4	Define Firewall? Explain the types of Firewalls. Give examples for each.	CO 4	L IV

SECTION B - ANSWER ANY 5 OUT OF 8 (To compulsorily have ONE question from each module)			4Q X 5 M = 20 M	
9	Module 1	Discuss various types of threats.	CO 1	L II
10	Module 1	Explain Confidentiality.	CO 1	L II
11	Module 2	Explain the Applications of Cryptographic Hash Functions.	CO 2	LII
12	Module 2	Explain SHA algorithm.	CO 2	L II
13	Module 3	Explain the Access Control Principles.	CO 3	LII
14	Module 3	Write a short note on Database Access Control.	CO 3	LIII
15	Module 4	Give an account on Payload-Stealthing-Backdoors.	CO4	L II
16	Module 4	Explain the Firewall Characteristics in detail.	CO4	L IV

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Osmania University,
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c) Question Paper Blueprint

Modules	Hours Allotted in the Syllabus	CO Addressed	Section A (No. of Questions)	Total Marks	Section B (No. of Questions)	Total Marks
1	15	CO-1	2	4x10=40	8 (By taking two questions from each Module)	5x4=20
2	15	CO-2	2			
3	15	CO-3	2			
4	15	CO-4	2			

9. CO-PO Mapping

CO	PO	Cognitive Level	Classroom sessions (hrs)
1	1	Identify	15
2	1,2	Explain	15
3	1, 2	Identify	15
4	1, 2	Discuss	15

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Hyderabad-500 007.

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INFORMATION SECURITY

Practical Syllabus

1. Course Description

Programme:	**M.Sc. Computer Science (AI & ML)**	**Max. Hours: 60**
Course Code:	**P26/CAI/DSC/204/P**	**Hours per week: 4**
Type of Course:	**DSC**	**Max. Marks: 50**
No. of Credits:	**2**	

2. Course Objectives

- To understand the concepts of information security in a LAN and the Internet.
- To apply the security algorithms

3. Course Outcomes

After the successful completion of the course, the student will be able to:

CO1: Understand and explore digital signatures and authentication protocols to address security challenges.

CO2: Apply cryptographic algorithms and protocols in programming to achieve computer security.

4. Course Content

1. Implement Caesar Cipher encryption and decryption.
2. Implement Affine Cipher.
3. Implement Playfair Cipher using a user defined key.
4. Implement Vigenere (Polyalphabetic) Cipher.
5. Implement Hill Cipher.
6. Implement RSA encryption and decryption.
7. Implement Simplified DES algorithm.
8. Perform AES encryption using OpenSSL.
9. Generate hash values using MD5 / SHA-256.
10. Create and verify digital signatures (using OpenSSL).
11. Capture and analyze network packets using Wireshark.
12. Perform port scanning using Nmap.
13. Demonstrate ARP spoofing in a controlled environment.
14. Configure Snort IDS to detect network attacks.
15. Host-Based Intrusion Detection (Login Monitor)

Practical Sessions-Open-SourceTools:

- Kali Linux
- Wireshark, OpenSSL, Snort IDS
- Wireshark, OpenSSL, Snort IDS

Prepared by	Checked &Verified by	Approved by
Ms. Jyothi Reddy **Teaching faculty**	**Dr. Sr. Sujatha Yeruva** **HoD**	**Prof. Uma Joseph** **Principal**

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

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