M. C. E. Society's
Abeda Inamdar Senior College
Of Arts, Science and Commerce, Camp, Pune-1
(Autonomous) Affiliated to Savitribai Phule Pune University
NAAC accredited 'A' Grade

Syllabus as Per 2026 NEP 2.0 Guidelines

M. Sc (Computer Science) Syllabus

(Choice Based Credit System NEP 2026 Pattern)

Academic Year 2026-2027

(W.E.F. JUNE 2026-2027)

M. Sc(Computer Science) Syllabus as per NEP Guidelines Choice Based Credit System NEP 2026 Pattern (W.E.F. 2026-2027)

Class	Semester	Nature of Subject	Course Code	Title of the Paper	Credits
M.Sc(CS)-I	Sem-I	**Major Mandatory**	26SMCS11MM	React JS	**4**
		Major Mandatory	26SMCS12MM	Design and Analysis of Algorithms	**4**
		Major Mandatory	26SMCS13MM	Natural Language Processing	**2**
		Major Mandatory	26SMCS14MM	Practical -React JS	**4**
		Major Elective	26SMCS11MEA	NoSQL Database Technologies	**2**
		Major Elective	26SMCS12MEA	Practical-NoSQL Database Technologies	**2**
		Major Elective	26SMCS11MEB	Soft Computing	**2**
		Major Elective	26SMCS12MEB	Practical - Soft Computing	**2**
		RM	26SMCS1RM	Research Methodology	**4**

M.Sc(Computer Science) Major Paper I

Semester I

(w. e. f. 2026-2027)
Choice Based Credit System (NEP 2026 Pattern)

Course/ Paper Title	React JS
Nature of Course	**Mandatory Major**
Course Code	**26SMCS11MM**
Semester	I
No. of Credits	4
No. of teaching hours	60 Hrs.

Program Specific Outcomes

Sr. No.	Program Specific Outcomes
PSO 1	Design and develop modern web applications using React.js and component-based architecture.
PSO 2	Effectively manage state in React applications using **hooks, Context API, and Redux** for scalable solutions.
PSO 3	Implement dynamic routing, form handling, and event-driven interfaces in single-page applications.
PSO 4	Integrate external APIs and handle asynchronous data, errors, and loading states in React projects.
PSO 5	Understand and apply Flux and Redux architectures for structured and maintainable front-end development.

Course Outcomes

CO No.	Cognitive Level	Course Outcome
CO1	R1, U2	Understand the fundamentals of React.js, including its evolution, SPA concept, virtual DOM, project setup, and development workflow.
CO2	R1, U2	Develop React components using **JSX**, functional and class components, and manage component lifecycle and composition.
CO3	A3 U2 A4	Implement **props, state, and hooks** for dynamic data handling, event handling, and conditional rendering in React applications.
CO4	A4 A3	Apply client-side routing and form management in React using **React Router**, controlled/uncontrolled components, and validation techniques.
CO5	E5 A4	Integrate **state management and APIs** using Context API, Redux, Flux architecture, and handle asynchronous data with fetch

CO- PO Mapping Matrix

	PO					PSO				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	2	2	1	2	3	2	1	1	1
CO2	3	2	3	2	2	3	3	2	1	2
CO3	3	3	3	2	2	2	3	3	2	2
CO4	2	3	3	3	2	2	2	3	3	2
CO5	2	3	3	3	3	2	3	2	3	3
AVG	3	2	2	1	2	3	2	1	1	1

Unit No.	Title with Contents	No. of Lectures
I	**Introduction to React**	10
	i. Evolution of Front-end Frameworks. ii. Introduction to Single Page Application (SPA) iii. Overview of React JS • What is React JS? • Why to use React JS? • Work flow of React JS • Scope of React JS iv. Virtual DOM and real DOM v. Setting up development environment: • Create-react-app • Vite • Folder structure and project setup • Running the app • Debugging the first react app vi. How to create package.json and purpose of it? vii. Anatomy of react project	
II	**JSX & Components**	08
	i. Introduction to JSX ii. Expression & Attributes in JSX iii. JavaScript expressions in JSX iv. Difference between JS and JSX. v. Functional Components vi. Class Components vii. Child Components viii. Namespaced Components ix. Mounting Components x. Updating Components xi. Component Lifecycle xii. Component composition and resuse xiii. Writing your first React.js Component	
III	**Props, State, React Hooks and Event Handling**	10
	i. Props and Data flow ii. State and its Management iii. Introduction to Hooks iv. UseState Hook v. useEffect Hook	

	vi. Rules of Hook vii. Custom Hook viii. Event Handling in React JS ix. Conditional Rendering x. Lists and Keys	
IV	**Routing and Forms**	**12**
	i. Client-side routing ii. Using React Router iii. Navigation and dynamic routes iv. Forms in React v. Controlled and Uncontrolled form components vi. Stateful and Stateless form Components in React vii. Form Validation basics	
V	**State Management and API**	**12**
	i. Integration ii. Context API iii. Introduction to Redux iv. Fetch API and Axios v. Handling Asynchronous data vi. Error Handling and loading States	
VI	**FLUX , REDUX**	**08**
	i. Introduction to Flux ii. Flux Architecture iii. Flux Components iv. Stores, Dispatchers, View Controllers, Actions, Views v. Introduction to One Store vi. Provider, Actions, Reducers, Sagas , Selector vii. What is Redux? viii. Why to use Redux ix. Redux Architecture x. Principles of Redux	

References:

1. https://blog.hubspot.com/website/react-js
2. https://legacy.reactjs.org/docs/components-and-props.html
3. https://legacy.reactjs.org/docs/introducing-jsx.html
4. https://react-redux.js.org/introduction/getting-started
5. https://coreui.io/react/docs/forms/overview/

M.Sc(Computer Science) Major Paper I

Semester I

(w. e. f. 2026-2027)
Choice Based Credit System (NEP 2026 Pattern)

Course/ Paper Title	Practical-React JS
Nature of Course	**Mandatory Major**
Course Code	**26SMCS14MM**
Semester	1
No. of Credits	4
No. of teaching hours	60 Hrs.

Program Specific Outcomes

Sr. No.	Program Specific Outcomes
PSO 1	Set up React.js projects and develop structured, component-based applications.
PSO 2	Manage application data efficiently using **state, props, and hooks**.
PSO 3	Design dynamic user interfaces with proper **event handling, forms, and validation**.
PSO 4	Integrate React concepts to develop **interactive applications and games**.
PSO 5	Apply React.js best practices for **scalable, maintainable, and responsive front-end development**.

Course Outcomes

CO No.	Cognitive Level	Course Outcome
CO1	R1, U2	Install React.js, set up the development environment, and create a basic React application.
CO2	R1, U2	Understand and implement **components** and manage **state** in React applications.
CO3	A3 U2 A4	Use **props, hooks, and state management** for dynamic and interactive React components.
CO4	A4 A3	Develop forms with **validation** and handle user input effectively in React.
CO5	E5 A4	Build complete **applications and games** using React.js concepts for real-world problem solving.

CO- PO Mapping Matrix

	PO					PSO				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	2	2	1	2	3	1	1	1	1
CO2	3	3	2	2	2	3	3	2	2	2
CO3	3	3	3	2	2	2	3	3	2	3
CO4	2	3	3	2	2	2	2	3	2	2
CO5	3	3	3	3	3	3	3	3	3	3
AVG	3	2	2	1	2	3	1	1	1	1

Syllabus

Assignment No.	Assignments	No. of Sessions
1.	Assignment 1 Installation and creating Basic app with React JS	02
2.	Assignment 2 Components and State	02
3.	Assignment 3 Props, Hooks and State Management	02
4.	Assignment 4 Forms and Validation	02
5.	Assignment 5 Applications & Games using React JS	02

M.Sc(Computer Science) Major Paper I

Semester I

(w. e. f. 2026-2027)
Choice Based Credit System (NEP 2026 Pattern)

Course/ Paper Title	Design and Analysis of Algorithms
Nature of Course	**Major Mandatory**
Course Code	**26SMCS12MM**
Semester	I
No. of Credits	4
No. of teaching hours	60 Hrs.

Program Specific Outcomes

Sr. No.	Program Specific Outcomes
PSO 1	Understand how to analyze algorithms' efficiency in terms of time and space requirements.
PSO 2	Implement divide and conquer techniques like binary search, merge sort, and quicksort.
PSO 3	Apply greedy algorithms to problems such as scheduling, building minimum spanning trees, and data compression.
PSO 4	Use dynamic programming to solve complex problems like shortest paths, sequence alignment, and resource allocation
PSO 5	Solve problems involving backtracking, branch and bound, and graph algorithms like DFS, BFS, and topological sort.

Course Outcomes

CO No.	Cognitive Level	Course Outcome
CO1	R1, U2	Understand fundamental concepts of algorithms, including their design, analysis, and classification.
CO2	R1, U2	Apply divide and conquer, greedy, dynamic programming, and other strategies to solve various computational problems.
CO3	A3 U2 A4	Analyze the efficiency of algorithms using complexity measures like time and space.
CO4	A4 E5	Develop algorithms for real-world scenarios such as sorting, searching, scheduling, and routing.
CO5	E5 A4	Critically evaluate and select appropriate algorithmic approaches based on problem requirements.

CO- PO Mapping Matrix

	PO					PSO				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	2			1	3	1	1	1	1
CO2	3	3	2	2	3	2	3	3	3	
CO3	3	3		2	2	3	2	1		1
CO4	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3			3	3	
AVG	3	2			1	3	1	1	1	1

Syllabus

Unit No.	Title with Contents	No. of Lectures
I	**Basics of Algorithms** i. Algorithm definition and characteristics ii. Space complexity iii. Time complexity, worst case-best-case-average case iv. complexity, asymptotic notation v. Recursive and non-recursive algorithms	06
II	**Divide and conquer strategy** i. General method, control abstraction ii. Binary search iii. Merge sort, Quicksort iv. Comparison between Traditional Method of Matrix Multiplication vs. Strassen's Matrix Multiplication	08
III	**Greedy Method** i. Knapsack problem ii. Job sequencing with deadlines, iii. Minimum-cost spanning trees: Kruskal and Prim's algorithm iv. Optimal storage on tapes v. Optimal merge patterns vi. Huffman coding vii. Shortest Path :Dijkstra's Algorithm	08
IV	**Dynamic Programming** i. Principle of optimality ii. Matrix chain multiplication iii. 0/1 Knapsack Problem i. Merge & Purge ii. Functional Method iv. Bellman Ford Algorithm v. All pairs Shortest Path Floyd Warshall Algorithm	10

	vi. Longest common subsequence vii. String editing, Travelling Sales person problem	
V	**Decrease and Conquer**	**08**
	i. Definition of Graph, Representation of Graph ii. By Constant - DFS and BFS iii. Topological sorting iv. Connected components and spanning trees v. By Variable Size decrease Euclid's algorithm vi. Articulation Point and Bridges	
VI	**Backtracking**	**08**
	i. General method ii. Fixed Tuple vs. Variable Tuple Formulation iii. n- Queen's problem iv. Graph coloring problem v. Hamiltonian cycle vi. Sum of subsets	
VII	**Branch and Bound**	**08**
	i. Introduction ii. FIFO BB Search, LIFO Search iii. Definitions of LCBB Search iv. Bounding Function, Ranking Function v. Traveling Salesman problem Using Variable tuple vi. Formulation using LCBB vii. 0/1 knapsack problem using LCBB	

References:

1. Computer algorithms, Ellis Horowitz, Sartaj Sahni & Sangu the var Rajasekaran, Galgotia Publication
2. Algorithms , T. Cormen, C. Leiserson, & R. Rivest, , MIT Press
3. The Design and Analysis of Computer Algorithms, A. Aho, J. Hopcroft& J. Ullman, Addison Wesley
4. The Art of Computer Programming, Donald Knuth, Addison Wesley
5. The Algorithm Manual, Steven Skiena, Springer
6. Graphs, Networks and Algorithms, Jungnickel, Springer

M.Sc(Computer Science) Major Paper I

Semester I

(w. e. f. 2026-2027)
Choice Based Credit System (NEP 2026 Pattern)

Course/ Paper Title	Natural Language Processing
Nature of Course	**Major Mandatory**
Course Code	**26SMCS13MM**
Semester	I
No. of Credits	2
No. of teaching hours	30 Hrs.

Program Specific Outcomes

Sr. No.	Program Specific Outcomes
PSO 1	Understand and analyze fundamental concepts of Natural Language Processing, including linguistic structures, ambiguity, and levels of language processing.
PSO 2	Apply word-level and syntactic analysis techniques such as morphology, finite state models, POS tagging, and context-free grammars.
PSO 3	Utilize probabilistic and statistical models like Hidden Markov Models and Maximum Entropy for sequence labeling and language modeling
PSO 4	Perform semantic analysis by understanding lexical relationships, word sense disambiguation, and meaning representation in natural language.
PSO 5	Develop and implement NLP applications such as text summarization, text classification, and other real-world language processing systems.

Course Outcomes

CO No.	Cognitive Level	Course Outcome
CO1	R1, U2	Understand basic concepts and components of Natural Language Processing.
CO2	R1, U2	Apply word-level and syntactic analysis techniques in NLP.
CO3	A3 U2 A4	Analyze NLP models using probabilistic and statistical methods.
CO4	A4 A3	Implement semantic analysis for understanding language meaning.
CO5	E5 A4	Develop NLP applications like text summarization and classification.

CO- PO Mapping Matrix

	PO					PSO				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	2		1	1	3	1	1	1	1
CO2	3	3	2	2	3	2	3	2	2	2
CO3	3	3		3	2	3	2	3	2	2
CO4	3	3	3	3	2	2	2	2	3	2
CO5	3	3	3	3	3	2	2	2	3	3
AVG	3	2		1	1	3	1	1	1	1

Syllabus

Unit No.	Title with Contents	No. of Lectures
I	**Introduction to NLP**	4
	i. History of NLP ii. Generic NLP system iii. levels of NLP iv. Knowledge in language processing v. Ambiguity in Natural language vi. stages in NLP, vii. challenges of NLP viii. Applications of NLP	
II	**Word Level Analysis**	08
	i. Morphology analysis –survey of English Morphology, ii. Inflectional morphology & Derivational morphology, iii. Lemmatization, iv. Regular expression, v. finite automata, vi. finite state transducers (FST) vii. Morphological parsing with FST viii. Lexicon free FST Porter stemmer. N –Grams	
III	**Syntax analysis**	08
	i. Part-Of-Speech tagging(POS)- Tag set for English (Penn Treebank) ii. Rule based POS tagging iii. Stochastic POS tagging, iv. Issues –Multiple tags&words, Unknown words. v. Introduction to CFG vi. Sequence labelling: Hidden Markov Model (HMM), vii. Maximum Entropy	
IV	**Semantic Analysis**	10
	i. Lexical Semantics ii. Attachment for fragment of English sentences, noun phrases, Verb phrases, prepositional phrases	

	iii. Relations among lexemes & their senses – Homonymy Polysemy, Synonymy, Hyponymy, Robust Word Sense Disambiguation (WSD),Dictionary based approach	
V	**Text Summarization, Text Classification**	**06**
	i. Text summarization- LEXRANK , Optimization based approaches for summarization , Summarization evaluation ii. Text classification	

References:

1. Dan Jurafsky and James Martin. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition. Prentice Hall, Second Edition, 2009.

2. Chris Manning and Hinrich Schultz. Foundations of Statistical Natural Language Processing. MIT Press, Cambridge, MA: May 1999.

Web References:

1) https://www.javatpoint.com/nlp

2) https://www.ibm.com/topics/natural-language-processing

3)https://www.geeksforgeeks.org/natural-language-processing-overview

M.Sc.(Computer Science) Major Paper I

Semester I

(w. e. f. 2026-2027)
Choice Based Credit System (NEP 2026 Pattern)

Course/ Paper Title	NoSQL Database Technologies
Nature of Course	**Major Elective**
Course Code	**26SMCS11MEA**
Semester	I
No. of Credits	2
No. of teaching hours	30 Hrs.

Program Specific Outcomes

Sr. No.	Program Specific Outcomes
PSO 1	Understand core concepts of NoSQL databases and data models.
PSO 2	Apply different types of NoSQL databases like key-value, document, column-family, and graph.
PSO 3	Analyze data modeling, consistency, and distribution in NoSQL systems.
PSO 4	Perform schema migration and handle changes in NoSQL and RDBMS.
PSO 5	Design and select appropriate databases for real-world applications.

Course Outcomes

CO No.	Cognitive Level	Course Outcome
CO1	R1, U2	Understand core concepts, data models, and consistency in NoSQL databases.
CO2	R1, U2	Apply key-value, document, column-family, and graph database technologies.
CO3	A3 U2 A4	Analyze schema migration techniques in NoSQL and RDBMS systems.
CO4	A4 A3	Evaluate and choose databases based on performance, productivity, and application needs.
CO5	E5 A4	Design and implement NoSQL-based solutions for real-world scenarios.

CO- PO Mapping Matrix

	PO					PSO				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	2	1	1	1	3	1	2	1	1
CO2	3	3	2	2	3	2	3	2	2	2
CO3	3	3	2	2	2	3	2	3	2	2
CO4	2	2	3	2	2	2	2	3	2	2
CO5	3	3	3	3	3	3	3	3	3	3
AVG	3	2	1	1	1	3	1	2	1	1

Syllabus

Unit No.	Title with Contents	No. of Lectures
I	**Introduction to NOSQL (Core concepts)**	15
	i. Why NoSQL ii. Aggregate Data Models iii. Data modeling details iv. Distribution Models v. Consistency vi. Version stamps vii. Map-Reduce	
II	**Implementation with NOSQL databases**	10
	i. Key-Value Databases (Risk) ii. Document Databases (Mongodb) iii. Column-Family stores(Cassandra) iv. Graph databases (Neo4j)	
III	**Schema Migrations**	3

	i. Why it is necessary?
	ii. What is schema change?
	iii. Schema Change in RDBMS
	  i. Transition Phase
	iv. Schema Change in NOSQL
	  i. Incremental Migration
	  ii. Migration in Graph Database
	  iii. Changing Aggregate Structure	

IV	**Choosing your Database**	2
	iv. Programmer Productivity v. Data Access Performance vi. Difference between RDBMS & NOSQL	

References:

1. NoSQL Distilled, Pramod Sadalge, Martin Fowler
2. NoSQL for Dummies, A Willy Brand
3. http://nosql-database.org

M.Sc(Computer Science) Major Paper I

Semester I

(w. e. f. 2026-2027)
Choice Based Credit System (NEP 2026 Pattern)

Course/ Paper Title	Practical-NoSQL Database Technologies
Nature of Course	**Major Elective**
Course Code	**26SMCS12MEA**
Semester	I
No. of Credits	2
No. of teaching hours	30 Hrs.

Program Specific Outcomes

Sr. No.	Program Specific Outcomes
PSO 1	Design and create NoSQL databases using MongoDB.
PSO 2	Apply MongoDB queries to store and retrieve data efficiently.
PSO 3	Perform CRUD operations to manage data in MongoDB.
PSO 4	Develop graph-based data models using Neo4j and JSON.
PSO 5	Analyze and query graph databases using Neo4j query language.

Course Outcomes

CO No.	Cognitive Level	Course Outcome
CO1	R1, U2	Understand and create databases using MongoDB.
CO2	R1, U2	Write and execute queries in MongoDB for data retrieval.
CO3	A3 U2 A4	Perform CRUD operations (Create, Read, Update, Delete) in MongoDB.
CO4	A4 A3	Understand and build graph databases using Neo4j and JSON data.
CO5	E5 A4	Apply graph query techniques in Neo4j to analyze relationships.

CO- PO Mapping Matrix

	PO					PSO				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	2	2	1	2	3	2	1	1	1
CO2	3	3	2	2	3	3	3	2	1	1
CO3	3	2	3	2	3	3	2	3	1	1
CO4	2	2	3	2	2	2	2	2	3	2
CO5	2	3	2	3	2	2	3	2	2	3
AVG	3	2	2	1	2	3	2	1	1	1

Syllabus

Assignment No.	Assignments	No. of Sessions
6.	MongoDB Practical Assignment 1 based on data base creation	02
7.	MongoDB Practical Assignment 2 based on database creation with queries	02
8.	MongoDB Practical Assignment 3 based on CRUD operations	02
9.	Neo4J Practical Assignment 4 based on JSON graphs	02
10.	Neo4J Practical Assignment 5 based on Graph Queries	02

M.Sc(Computer Science) Major Paper I

Semester I

(w. e. f. 2026-2027)
Choice Based Credit System (NEP 2026 Pattern)

Course/ Paper Title	Soft Computing
Nature of Course	**Major Elective**
Course Code	**26SMCS11MEB**
Semester	I
No. of Credits	2
No. of teaching hours	30 Hrs.

Program Specific Outcomes

Sr. No.	Program Specific Outcomes
PSO 1	Understand the fundamentals of soft computing: neural networks, fuzzy logic, and genetic algorithms.
PSO 2	Apply neural network models and learning algorithms for pattern recognition and problem solving.
PSO 3	Analyze fuzzy sets, membership functions, and fuzzy inference systems for decision-making.
PSO 4	Implement genetic algorithms for optimization and search problems.
PSO 5	Design integrated soft computing solutions combining neural networks, fuzzy logic, and genetic algorithms for real-world applications.

Course Outcomes

CO No.	Cognitive Level	Course Outcome
CO1	R1, U2	Understand fundamentals of soft computing, including neural networks, fuzzy logic, and genetic algorithms.
CO2	R1, U2	Apply neural network architectures and learning algorithms for classification and prediction.
CO3	A3 U2 A4	Analyze fuzzy sets, fuzzy relations, and fuzzy inference systems.
CO4	A4 A3	Implement genetic algorithms for optimization and search problems.
CO5	E5 A4	Design integrated soft computing solutions for real-world applications.

CO- PO Mapping Matrix

	PO					PSO				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	2	1	1	1	3	1	1	1	1
CO2	3	3	2	2	3	2	3	1	2	2
CO3	2	2	3	2	2	2	1	3	1	2
CO4	2	2	2	3	2	1	2	1	3	2
CO5	3	3	3	3	3	3	3	2	3	3
AVG	3	2	1	1	1	3	1	1	1	1

Syllabus

Unit No.	Title with Contents	No. of Lectures
I	**Introduction to Soft Computing** i. Neural Networks: i. Definition ii. Advantages iii. Applications iv. Scope. i. Fuzzy logic: i. Definition ii.Applications ii. Genetic Algorithms: i. Definition ii.Applications.	02
II	**Neural Network** i. Fundamental Concept: i. Artificial Neural Network ii. Biological Neural Network, ii. Brain vs. Computer i. Comparison Between Biological Neuron and Artificial Neuron (Brain vs. Computer) ii. Artificial Neurons, iii. Neural Networks and Architectures: i. Neuron Abstraction ii. Neuron Single Functions iii. Mathematical Preliminaries iv. Neural Networks Defined, Architectures: i. Feed forward and Feedback ii. Salient Properties of Neural Networks v. Geometry of Binary Threshold Neurons and Their Networks: i. Pattern Recognition and Data Classification ii. Convex Sets iii. Convex Hulls and Linear Separability iv. Space of Boolean Functions v. Binary Neurons are Pattern Dichotomizers vi. Non-linearly Separable Problems	15

	vii. Capacity of a Simple Threshold Logic viii. Neuron Revisiting ix. the XOR Problem x. Multilayer Networks xi. How Many Hidden Nodes are enough? vi. Learning and Memory: i. An Anecodatal Introduction ii. Long Term Memory iii. The Behavioral Approach to Learning iv. The Molecular Problem of Memory v. Learning Algorithm vi. Error Correction and Gradient vii. Descent Rules viii. Learning Objective for TLNs ix. Pattern Space and Weight Space x. Linear Seperabilty xi. Hebb Network xii. Perceptron Network xiii. α- Least Mean Square Learning	
III	**Fuzzy Set Theory** i. Brief Review of Conventional Set Theory ii. Introduction to Fuzzy Sets iii. Properties of Fuzzy Sets iv. Operations on Fuzzy Sets v. Crisp Relation vi. Fuzzy Relation vii. Tolerance and equivalence relation viii. Fuzzy Tolerance and equivalence relation ix. Fuzzy Max-Min and Max-Product Composition Membership Functions x. Fuzzification, Defuzzification to crisp sets xi. λ-Cuts for fuzzy Relations xii. Fuzzy (Ruled-Based) system xiii. Graphical technique of inference xiv. Membership value assignment-Intuition Inference	**09**
IV	**Genetic Algorithms** i. What are Genetic Algorithms? ii. Why Genetic Algorithms? iii. Traditional Optimization and Search Techniques	**04**

	iv. Simple GA v. Terminologies and Operators in GA i. Encoding ii.Selection iii.Crossover iv.Mutation v.Search vi.Termination vii.Constraintsin GA	

References:

1. Fuzzy Logic With Engineering Applications, Timothy Ross, Wiley Publication
2. Introduction to Soft Computing, Deepa & Shivanandan, Wiley Publication
3. Genetic Algorithms in Search, Optimization and Machine Learning, David E. Goldberg, Pearson Education
4. Fundamentals of Neural Networks – Architectures, Algorithms, And Applications, Laurene Fausett, Pearson Education
5. Neural Networks, Satish Kumar, Tata McGrawHill

M.Sc(Computer Science) Major Paper I

Semester I

(w. e. f. 2026-2027)
Choice Based Credit System (NEP 2026 Pattern)

Course/ Paper Title	Practical - Soft Computing
Nature of Course	**Major Elective**
Course Code	**26SMCS12MEB**
Semester	I
No. of Credits	2
No. of teaching hours	30 Hrs.

Program Specific Outcomes

Sr. No.	Program Specific Outcomes
PSO 1	Apply fuzzy logic concepts to handle uncertainty and perform fuzzy operations.
PSO 2	Use fuzzy relation methods like composition and lambda cuts for decision-making.
PSO 3	Develop neural network models using learning rules and activation functions.
PSO 4	Implement supervised learning and backpropagation for prediction and classification.
PSO 5	Apply genetic algorithms to solve optimization problems using evolutionary techniques.

Course Outcomes

CO No.	Cognitive Level	Course Outcome
CO1	R1, U2	Understand and apply fundamental concepts of **fuzzy logic**, including operations such as union, intersection, complement, and fuzzy relations.
CO2	R1, U2	Analyze and implement fuzzy inference techniques including **De Morgan's laws, lambda cuts, and composition methods** (Max-Min and Max-Prod
CO3	A3 U2 A4	Develop and evaluate basic **artificial neural network models**, including activation functions.
CO4	A4 A3	Design and implement supervised learning algorithms and advanced neural network models using the **backpropagation algorithm** for solving classification problems.
CO5	E5 A4	Understand and simulate **evolutionary computation techniques**, including the genetic algorithm life cycle (selection, crossover, mutation) for optimization problems.

CO- PO Mapping Matrix

	PO					PSO				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	2	1	2	1	3	2	1	1	1
CO2	3	3	2	2	1	3	3	2	1	1
CO3	3	2	3	2	2	2	2	3	2	1
CO4	3	3	3	3	2	2	2	3	3	2
CO5	2	3	2	2	2	1	2	2	2	3
AVG	3	2	1	2	1	3	2	1	1	1

Syllabus

Unit No.	Title with Contents	No. of Practical Sessions
I	Write a program to implement Fuzzy Operations Union Intersection Complement Algebraic sum Algebraic product Cartesian product	15
	Write a program to implement De Morgans law.	
	Write a program to implement Max-Min Composition and Max-Product Composition.	
	Write a program to implement lambda cut	
	Write a program to implement Activation Function.	
	Write a program to implement Perceptron Learning Rule	
	Write a program to implement Hebb's Rule	
	Write a program to implement Feed Forward Network	
	Write a program for building an Artificial Neural Network by implementing the Back propagation Algorithm and test the same using appropriate data sets.	
	Write a program for solving linearly separable problem using Perceptron Model.	
	Write a program to develop supervised learning algorithm	
	Write a program to study and analyze genetic life cycle	

M.Sc(Computer Science) Major Paper I

Semester I

(w. e. f. 2026-2027)
Choice Based Credit System (NEP 2026 Pattern)

Course/ Paper Title	Research Methodology
Nature of Course	**RM**
Course Code	**26SMCS1RM**
Semester	I
No. of Credits	4
No. of teaching hours	60 Hrs.

Program Specific Outcomes

Sr. No.	Program Specific Outcomes
PSO 1	Understand the fundamentals of research, including objectives, ethics, and methodology.
PSO 2	Perform literature review and formulate clear and researchable problems.
PSO 3	Design appropriate research methods and sampling strategies for different types of studies.
PSO 4	Collect, process, and analyze data using quantitative and qualitative techniques.
PSO 5	Prepare, present, and document research findings through reports, papers, and presentations.

Course Outcomes

CO No.	Cognitive Level	Course Outcome
CO1	R1, U2	Understand research concepts, objectives, ethics, and methodology.
CO2	R1, U2	Conduct literature reviews and formulate research problems.
CO3	A3 U2 A4	Develop appropriate research designs and methods.
CO4	A4 A3	Apply hypothesis formulation, sampling, and data analysis techniques.
CO5	E5 A4	Prepare research reports and present findings effectively.

CO- PO Mapping Matrix

	PO					PSO				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	2	1	1	1	3	1	1	1	1
CO2	2	3	2	2	2	2	3	2	2	2
CO3	2	2	3	2	2	2	2	3	2	2
CO4	2	2	2	3	2	1	2	2	3	2
CO5	3	2	1	1	1	2	2	2	2	3
AVG	2	3	2	2	2	3	1	1	1	1

Unit No.	Title with Contents	No. of Lectures
I	**Introduction to Research Methodology** i. Meaning of Research ii. Objectives of Research iii. Motivation in Research iv. Types of Research v. Research Approaches vi. Significance of Research vii. Researcher and Characteristics of Researcher viii. Research Ethics and Integrity ix. Plagiarism and types of plagiarism x. Introduction to Plagiarism check tools xi. Research Methods versus Methodology xii. Research and Scientific Method xiii. Importance of Knowing How Research is Done Criteria of Good Research	10
II	**Literature Review and Formulation of Research Problems** i. Research Process ii. Reviewing the literature: the purpose of a literature review iii. Literature resources iv. The Internet and a literature review v. The Internet and research strategies and methods vi. Conducting and Evaluating literature reviews vii. Formulation of research problem i. What is a Research Problem? ii. Selecting the Problem iii. Necessity of Defining the Problem iv. Technique Involved in Defining a Problem	08
III	**Research Design** i. Meaning of Research Design ii. Need for Research Design iii. Features of a Good Design iv. Important Concepts Relating to Research Design v. Different Research Designs/Methods i. Pure and Applied Research ii. Exploratory or Formulation Research iii. Descriptive Research iv. Diagnostic Research v. Evaluation Studies vi. Action Research vii. Experimental Research	10

	viii. Analytical Study or Statistical Method ix. Historical Research x. Surveys xi. Case Study xii. Field Studies	
IV	**Hypothesis and Sampling** i. What is a Hypothesis? ii. Nature & Characteristics of Hypothesis iii. Significance of Hypothesis iv. Types of Hypothesis v. Sources of Hypothesis vi. Characteristics of Good Hypothesis vii. What is sampling? viii. Aims of Sampling ix. Characteristics of Good Sample x.Basis of Sampling xi.Merits and demerits of Sampling xii.Sampling Techniques or Methods xiii.Probability Sampling Methods xiv.Non-Probability Sampling Methods xv.Sample Design and Choice of Sampling Technique	**12**
V	**Data Collection, Processing, and Analysis of Data** i. Collection of Primary Data ii. Method of Data Collection - Observation, Interview, Questionnaires, andSchedules iii. Difference between Questionnaires and Schedules iv. Some Other Methods of Data Collection v. Collection of Secondary Data vi. Selection of Appropriate Method for Data Collection vii. Case Study Method viii. Processing Operations and Some Problems in Processing ix. Elements/Types of Data Analysis x. Statistics in Research xi. Measures of Central Tendency, Dispersion, Asymmetry (Skewness) xii. Measures of Relationship - Chi-Square, t-test, ANOVA i. (f-test),Z-test xiii. Simple Regression Analysis, Multiple Correlation, and Regression xiv. Partial Correlation and Association in Case of Attributes	**12**

	xv. Quantitative and Qualitative Data Analysis Tools	
VI	**Report Writing**	**08**
	xi. Significance of Report Writing xii. Different Steps in Writing Report xiii. Layout of the Research Report xiv. Types of Reports (Research Proposal/Synopsis, Research Paper, and Thesis) xv. Oral Presentation xvi. Mechanics of Writing a Research Report xvii. Precautions for Writing Research Reports	

References:

1. Business Research Methods – Donald Cooper & Pamela Schindler, TMGH, 9th edition
2. Business Research Methods – Alan Bryman & Emma Bell, Oxford University Press.
3. Research Methodology – C.R.Kothari
4. B A Prasad Sharma and P. Satyanarayan. Ed.(1983): Research Methods in Social Sciences,New Delhi: Sterling
5. Bridget Somek and Cathy Lewin (2005): Research Methods in the Social Sciences, New Delhi: Sage.