"Dissemination of Education for Knowledge, Science and Culture"
-Shikshanmaharshi Dr. Bapuji Salunkhe

VIVEKANAND COLLEGE, KOLHAPUR

(AN EMPOWERED AUTONOMOUS INSTITUTE)

DEPARTMENT OF COMPUTER SCIENCE

Two Years PG Programme

Department/Subject Specific Core or Major (DSC)

Curriculum, Teaching and Evaluation Structure

for

M.Sc. II Computer Science

Semester: III & IV

(Implemented from academic year 2024-25 onwards)

VIVEKANAND COLLEGE, KOLHAPUR

(AN EMPOWERED AUTONOMOUS INSTITUTE)

DEPARTMENT OF COMPUTER SCIENCE

Syllabus for the Master of Science in Computer Science
M. Sc. II (Sem. III & IV)
As per NEP-2020 Guidelines
Applicable from Academic Year: 2024 – 2025

1. **Title**: M. Sc. Computer Science,
   Vivekanand College, Kolhapur (An Empowered Autonomous Institute)
2. **Faculty**: Faculty of Science and Technology.
3. **Year of Implementation**: For M. Sc. I (Semester I and Semester II): From July 2023 and for M. Sc. II (Semester III and Semester IV): From July 2024.
4. **Programme Outcomes (POs):**

   After completing the M. Sc. Programme, the students will able to:
   PO1: Demonstrate and apply the fundamental knowledge of the basic principles of sciences in various fields.
   PO2: Create awareness and a sense of responsibility towards the environment and society to solve the issues related to environmental pollution.
   PO3: Apply their professional, social, and personal knowledge.
   PO3: Competent to pursue research or pursue a career in the subject.
   PO4: Apply knowledge to build up small-scale industries for developing endogenous products.
   PO5: Communicate scientific information in a clear and concise manner both orally and in writing.
   PO6: Inculcate logical thinking to address a problem and become result oriented with a positive attitude.

5. **Programme Specific Outcomes (PSOs):**

   After completing the M. Sc. (Computer Science) Programme, the students will able to:
   PSO1: To analyse complex computational problems, develop innovative solutions, and apply mathematical and algorithmic principles to address a wide range of real-world challenges.
   PSO2: Proficient in multiple programming languages and software development methodologies, enabling them to design, develop, and maintain software systems of varying complexity.
   PSO3: Equipped with the skills necessary to engage in cutting-edge research in computer science, including the ability to identify research problems, conduct experiments, and contribute to the development of new knowledge in the field.
   PSO4: Proficient in data analysis techniques and machine learning algorithms, allowing them to extract valuable insights from data, build predictive models, and apply machine learning to a variety of domains.
   PSO5: understand the principles of cybersecurity and information assurance, enabling them to assess and mitigate security risks, protect data and systems, and contribute to the development of secure software and network infrastructures.
   PSO6: ability to collaborate effectively in multidisciplinary teams, communicate technical information clearly to both technical and non-technical audiences, and adapt to changing technologies and work environments.

Teaching and Evaluation Scheme

DEPARTMENT OF COMPUTER SCIENCE

M. Sc. II (Sem. III & IV) From Academic Year: 2024 – 2025

Sr. No.	Course Abbr.	Course code	Course Name	Teaching Scheme Hours/week		Examination Scheme and Marks				Course Credits
				TH	PR	ESE	CIE	PR	Marks	
Semester-III										
1	DSC-V	DSC19CSC31	Mobile Application Development with Flutter	4	-	80	20	-	100	4
2	DSC-VI	DSC19CSC32	Artificial Intelligence	4	-	80	20	-	100	4
3	DSE-III	DSE19CSC31	Cyber Security	4	-	80	20	-	100	4
		DSE19CSC32	Cloud Computing		-			-		
		DSE19CSC33	Human Computer Interaction		-			-		
4	DSC-PR-III	DSC19CSC39	Computer Science Lab-III	-	12		-	150	150	6
5	RPR-I	RPR19CSC31	Research Project	-	4		-	-	100	4
			Semester-III Total	**12**	**16**	**240**	**60**	**150**	**550**	**22**
Semester-IV										
1	DSC-VII	DSC19CSC41	Software Project Management	4	-	80	20	-	100	4
2	DSC-VIII	DSC19CSC42	Natural Language Processing	4	-	80	20	-	100	4
3	DSC-IX	DSC19CSC43	Cryptography and Network Security	4	-	80	20	-	100	4
4	DSE-IV	DSE19CSC41	Remote Sensing and GIS	4	-	80	20	-	100	4
		DSE19CSC42	Decision Support Systems		-			-		
		DSE19CSC43	Python for Data Analytics		-			-		
5	RPR-II	RPR19CSC41	Research Project	-	6	-	-	-	150	6
			Semester-IV Total	**16**	**6**	**320**	**80**	**100**	**550**	**22**
			Total (Sem. III & IV)	**28**	**22**	**560**	**140**	**250**	**1100**	**44**

M. Sc. Computer Science Part – II: Semester – III

DSC-V (DSC19CSC31): Mobile Application Development with Flutter

Course Outcomes: Students will able to

CO1: Understand the core concepts and architecture of Flutter and understanding Dart.

CO2: Apply Flutter widgets and layout mechanisms to build interactive and responsive user interfaces.

CO3: Analyze and integrate backend services and databases using Flutter, Firebase, and SQLite.

CO4: Design, develop, test, and deploy complete Flutter applications.

UNIT-I	Introduction to Flutter: Features of Flutter, Advantages and Disadvantages of Flutter, Flutter Benefits, how flutter works? Flutter Installation, Architecture of Flutter Application, Introduction to Dart Programming: Basic Programming, OOP Concepts, Exception Handling, Debugging, Asynchronous Programming	**20**
UNIT- II	Introduction to Layouts: Widgets-Types, Gestures, Statement Management, State management, Scoped Model, Navigation and Routing, UI Design-Styles and Assets, Fonts, Model API, Lists and Grids, Drawing and Painting, Animation on Flutter.	**20**
UNIT- III	Database Concepts: SQLite-Cloud Fire store, Internalization of Flutter-Using intl Package, Flutter and Firebase: Firebase and its features, integrating firebase, User Authentication, Testing, Debugging and Deployment	**20**

References:

1. Beginning Flutter: A Hands-on Guide to App Development by Marco L. Napoli, Wiley publication.
2. Flutter in Action by Eric Windmill, Manning publication
3. Google Flutter Mobile Development Quick Start Guide by Prajyot Mainkar, Salvatore Giordano, Packt Publishing Ltd
4. Flutter for Beginners by Alessandro Biessek, Packt Publishing Ltd
5. Dart for Absolute Beginners by David Kopec, Apress publication.

DSC-VI (DSC19CSC32): Artificial Intelligence

Course Outcomes: Students will able to

CO1: Become familiar with basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning.

CO2: Investigate applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.

CO3: Explore the current scope, potential, limitations, and implications of intelligent systems.

CO4: Apply their knowledge to real-world problems using AI trends and will be able address challenges in applications and provide solutions.

UNIT-I	**Introduction to Artificial Intelligence** Definitions, History, Goals of AI, AI approaches, AI Techniques, Branches and Applications of AI, Intelligent Agents- Characteristics, Structures, Types, Problem Solving methods, Search and Control Strategies, Search Techniques- Blind (-BFS, DFS, DLS, Iterative Deepening, Search, Bidirectional Search, Uniform cost Search), Heuristics (Generate and test, Hill Climbing, Best First search, Constraint Satisfaction, Mean-End Analysis, A*, AO*)	**20**
UNIT- II	**Knowledge Representation, Reasoning, Planning and Game Theory** KR introduction, approaches, methods, Logic, Propositional Logic, Predicate Logic, KR using rules, KR and Reasoning, Approaches to reasoning, Symbolic reasoning, Statistical Reasoning, Semantic Nets, Frames, Classical Planning, Automated Planning, Algorithms for Classical Planning, Heuristics for Planning, Hierarchical Planning, Overview of Game Theory, Mini-max theorem, Taxonomy of Games, Tic-tac-toe game, evaluation, Alpha-Beta pruning	**20**
UNIT- III	**Trends in Artificial Intelligence** **Artificial Neural Network** Introduction, biological neuron model, Model of artificial neuron, Artificial neuron – basic, elements, activation functions, Neural network architectures, Learning Methods in Neural Networks, Classification of learning algorithms, Single-Layer NN System, Learning algorithms for training, Applications of ANN. **Fuzzy Set Theory and Fuzzy Systems** Introduction to Fuzzy Sets, Fuzzy Set Theory, Fuzzy Memberships, Fuzzy Operations, Fuzzy Properties, Fuzzy Relations, Fuzzy Systems, Fuzzy System elements, Fuzzification, Fuzzy Inference, Fuzzy rule based systems	**20**

References:

1. Introduction to Artificial Intelligence By Eugene Charniak, Drew McDermott- Addison Wesley
2. Neural Networks and fuzzy systems A dynamical systems approach to machine Intelligence by Bart Kosko- PHI
3. Artificial Intelligence by Elaine Rich, Kevin Knight, S Nair TMH
4. Artificial Intelligence: A Modern Approach, S. Russel and P. Norvig
5. Introduction to Artificial Intelligence and Expert Systems by D W Patterson, PHI, 2nd Edition.

DSE-III (DSE19CSC31): Cyber Security

Course Outcomes: Students will able to

CO1: Analyze and evaluate the cyber security needs

CO2: Understand types of vulnerabilities

CO3: Implement cyber security solutions, information assurance, and cyber security tools software/tools

CO4: Comprehend and execute risk management processes, risk treatment methods in order to mitigate the security risk

UNIT-I	**Introduction of Cyber Security** Introduction of Cyber Security, Computer Security, Threats, Harm, Vulnerabilities, Controls, Authentication, Access Control and Cryptography, Network Vulnerabilities: Overview of vulnerability scanning, Open Port / Service Identification, Banner /Version Check, Traffic Probe, Vulnerability Probe, Vulnerability Examples, OpenVAS, Metasploit. Networks Vulnerability Scanning (Netcat, Socat), Network Sniffers and Injection tools.	**20**
UNIT- II	**Cyber Security Attacks** Web-based Attacks (Injection Attack, DNS Spoofing, Session, Hijacking, Phishing, Brute Force, Denial of Service, Distributed Denial of Service, Dictionary, Attack, URL Interpretation, File Inclusion Attack, Man in the Middle Attack), System-based Attacks (Virus, Worm, Trojan Horse, Backdoors, Bots), Types of Cyber Attackers. Cyber Security Tools- Cyber Security Goals, Tools for Confidentiality - Encryption, Access control, Authentication, Authorization, Physical Security, Tools for Integrity - Backups, Checksums, Data Correcting Codes, Tools for Availability - Physical Protections, Computational redundancies.	**20**
UNIT- III	**Cyber Security Principles, Technologies, Challenges and Risk Awareness** Cyber Security Principles, Data Security Consideration, Firewalls, Types of Firewalls, Basics of Virtual Private Network, Basics of Intrusion Detection, Digital Signature and Types of Digital Signature, Importance of Security Standards, ISO/IEC 27001 and 27002, NIST Cyber Security Framework, Common Criteria, Cyber Security Challenges, Challenges associated with the evolution of ransom ware, block chain, Internet of Things (IoT), Artificial Intelligence, Server less Apps, Security Analysis Benefits and Steps, Quantitative and Qualitative Security Risk Analysis.	**20**

References:

1. Charles J. Brooks, Christopher Grow , Philip Craig, "Cybersecurity Essentials", John Wiley and Sons, 2018
2. Mayank Bhusan, Rajkumar Singh Rathore, Aatif Jamshed, Fundamental of Cyber Security: Principles, Theory and Practices, BPB Publications.
3. Paul A. Watters, Cyber Security: Concepts and Cases, CreateSpace Independent Publishing Platform
4. David Sutton, Cyber Security: A Practitioner's Guide, BCS Learning & Development Limited, 2017.
5. Cryptography and Network Security by Atul Kahate
6. Crystal Panek, "Security Fundamentals", John Wiley and Sons, 2019.
7. Micki Krause, Harold F.Tripton, “Information Security Management Handbook”, Auerbach Publications, 2012.
8. Mark Talabis, “Information Security Risk Assessment Toolkit: Practical Assessments through Data Collection and Data Analysis”, Kindle Edition. ISBN: 978-1-59749-735-0.

DSE-III (DSE19CSC32): Cloud Computing

Course Outcomes: Students will able to

CO1: Identify and describe the key concepts, service models, and deployment models of cloud computing

CO2: Explain the hands-on implementation of cloud services and applications, including security practices and resource management techniques

CO3: Analyze various architectural patterns for cloud computing solutions and evaluate their effectiveness in addressing specific business needs

CO4: Design and propose a comprehensive cloud computing solution for a given requirement, integrating concepts from all three modules and documenting the architecture, technologies, and implementation strategies.

UNIT-I	**Introduction to Cloud Computing** Definition and characteristics, Historical evolution of cloud computing, Key drivers for cloud adoption, Cloud Service Models- Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS), Cloud Deployment Models- Public, Private, Hybrid, and Community Clouds, Comparison of deployment models, Core Principles of Cloud Computing, Virtualization and resource pooling- Scalability, elasticity, and on-demand self-service, Multi-tenancy and security considerations	**20**
UNIT- II	**Hands-On Cloud Computing** Cloud Infrastructure Setup - Setting up cloud environments (AWS, Azure, Google Cloud), Understanding cloud storage and databases, Developing Cloud Applications - Building and deploying applications in the cloud, Using cloud services for application development, Cloud Security and Compliance - Security best practices in cloud computing, Compliance frameworks and regulations, Monitoring and Managing Cloud Resources - Tools for cloud resource management, Performance monitoring and optimization	**20**
UNIT- III	**Advanced Cloud Architectures and Solutions** Architectural Patterns in Cloud Computing- Microservices architecture, Serverless architecture, Event-driven architecture, Designing Cloud Solutions - Best practices for cloud architecture design, Case studies of successful cloud implementations Emerging Trends in Cloud Computing - AI and machine learning in the cloud Edge computing and IoT integration, Future Directions and Challenges - Ethical considerations in cloud computing, Future trends and potential disruptions in cloud technology.	**20**

References:

1. Cloud Computing: Principles and Paradigms by Rajkumar Buyya, James Broberg, and Andrzej M. Goscinski
2. Cloud Computing: A Hands-On Approach by Arshdeep Bahga and Vijay Madisetti
3. Architecting Cloud Computing Solutions by Kevin L. Jackson, Scott Destatte, and Clyde Louthan
4. Learning Cloud Computing: A Hands-On Guide to the Fundamentals of Cloud Computing by Gilbert Held
5. Cloud Native Architecture: Designing and Deploying Cloud-Native Applications by Nitin K. Goel

DSE-III (DSE19CSC33): Human Computer Interaction

Course Outcomes: Students will able to

CO1: List and describe the core concepts and theories of Human-Computer Interaction, including historical perspectives and human cognitive processes.

CO2: Explain the principles of user-centered design and the significance of mental models in the design of interactive systems.

CO3: Analyze various user research methods and evaluate their effectiveness in informing design decisions and improving usability.

CO4: Explain the principles of user-centered design and the significance of mental models in the design of interactive systems.

UNIT-I	**Foundations and Principles of HCI** Introduction to HCI: Historical perspective, Core concepts and theories, Human cognitive processes. Design Principles: Mental models, Design patterns, User-centered design. Design Process: Design thinking methodology, Prototyping techniques, Wireframing, Design documentation	**20**
UNIT- II	**Research Methods and Evaluation** User Research Methods: Qualitative research methods, Quantitative research methods, Data collection techniques, Research planning. Evaluation Techniques: Usability testing, Heuristic evaluation, Cognitive walkthrough, Analytics and metrics. Research Analysis: Data analysis methods, Statistical evaluation, Reporting findings, Research ethics	**20**
UNIT- III	**Advanced Interaction and Applications** Advanced Interaction Technologies: Natural user interfaces, Gesture and touch interaction, Voice and multimodal interfaces VR/AR interfaces. Specialized Applications: Universal design, Accessibility, Social computing, AI in HCI Future Directions: Emerging technologies, Future interaction paradigms, Ethics in HCI, Final presentations	**20**

References:

1. Interaction Design: Beyond Human-Computer Interaction by Helen Sharp, Yvonne Rogers, Jenny Preece
2. Human-Computer Interaction by Alan Dix, Janet Finlay, Gregory D. Abowd, Russell Beale
3. Research Methods in Human-Computer Interaction by Jonathan Lazar, Jing Feng, and Harry Hochheiser
4. Interaction Design: Beyond Human-Computer Interaction by Helen Sharp, Yvonne Rogers, Jenny Preece
5. Human-Computer Interaction: A Concise Introduction by S. K. Soni

DSC-PR-III (DSC19CSC39): Computer Science Lab-III

Practical's based on DSC19CSC31:

1. Set up the Flutter environment and create a simple "Hello World" mobile app.
2. Write Dart programs to demonstrate data types, control structures, functions, OOP, and exception handling.
3. Create a responsive UI using StatelessWidget and StatefulWidget with layout widgets like Column, Row, Container, ListView, etc.
4. Design a form (e.g., user registration) with real-time input validation using TextFormField and form state management.
5. Implement navigation between multiple pages using named and unnamed routes.
6. Build a counter or to-do app using Scoped Model or Provider for state management.
7. Display a list/grid of items (e.g., products or contacts) using ListView.builder() and GridView.
8. Create an app with Create, Read, Update, Delete(CRUD) functionality using SQLite or Firestore.
9. Implement Firebase authentication with Email/Password or Google sign-in.
10. Develop a complete Flutter app with features like navigation, data handling, Firebase integration, and deployment.

Practical's based on DSC19CSC32:

1. Implement the program on Uninformed Search Techniques.
2. Implement the program on Informed Search Techniques.
3. Implement a program on Travelling Salesman Problem.
4. Implement a program on Alpha-Beta Pruning.
5. Implement a program on Tower of Hanoi.
6. Implement a program on Tic-Tac-Toe game.
7. Implement a program on Water-Jug problem.
8. Implement a program on 8-Puzzle problem.
9. Implement a program on Monkey Banana Problem.
10. Implement a program on 8-Queens Problem.

Practical's based on DSE19CSC31:

1. Perform foot printing (the first step in hacking) by gathering information about a target system using tools
2. Learn to configure and enable a personal firewall on your system. Block specific ports and allow necessary ones.
3. Install and configure an antivirus program on a system and perform a full system scan, Malware detection, antivirus setup, basic malware protection etc.
4. Set up a secure Wi-Fi network by changing default router settings.
5. Use file encryption tools to encrypt files and folders to protect sensitive data.
6. Use Nmap (Network Mapper) to scan networks, detect open ports, services, and identify potential vulnerabilities.
7. Use Wireshark to capture and analyze network traffic. Learn to identify suspicious activity, unencrypted data, and protocol anomalies in network communications.
8. Use the Metasploit Framework to identify and exploit vulnerabilities on a vulnerable machine.

9. Simulate a wireless network using the 802.11 (Wi-Fi) or 802.15 (Bluetooth) protocols in NS2. Analyze throughput, packet delivery ratio, and delay in different mobility scenarios.
10. Simulate common web application attacks like Cross-Site Scripting (XSS) and SQL Injection.

RPR-I (RPR19CSC31): Research Project

Research Project based on RPR19CSC31:

Research Project Paper Guidelines

1. The students should write a synopsis of the proposed research work.
2. The students should perform a detailed literature survey related to the research problem.
3. The students should write a review article related to the research problem.
4. It is expected to publish the review article in peer-reviewed journals.
5. The students should design the problem and start experimental work. The students should complete at least 25% of their experimental work during semester III and the same work to be continued in semester IV.
6. The student should submit the spiral-bound copy of research work carried out during semester III including the synopsis, research proposal, review article and certified progress report.
7. The Research Project will be examined jointly by internal and external examiners during the practical examination at the end of the semester.
8. The students should present their work during the evaluation in the form of PowerPoint presentation (PPT).

Marking Scheme:

Sr. No.	Description	Marks
1	Synopsis	10
2	Research Proposal	20
3	Review article on proposed work	20
4	Daily Lab notebook record	10
5	Progress of Experimental work	20
6	Quality and effectiveness of presentation	20
	Total	**100**

Broad guidelines for the preparation of synopsis

A. The proposed synopsis for research should be self-contained and should cover the rationale for carrying out research.

B. There should not be a repetition of the work topic or theme.

C. The synopsis of the proposed research shall contain the following points :

1 Title of the Research Proposal

2 Motivation with reasoning and significance of the proposed research

3 Statement of the problem

4 Review of the relevant literature

1. Objectives of the study

2. The methodology comprising

a) Methods of research

b) Sampling design and assumptions

c) Conceptual framework if any

d) Research design (explanation of how research is being conducted and the tools used for the same)

e) Methods of data collection

f) Methods of data analysis (use of parametric and non-parametric tools and techniques as the case may be)

3. Expected outcome

4. References/Bibliography.

Template for Research Proposal

1. Title

2. Introduction

3. Origin of the research problem

4. Interdisciplinary relevance

5. Review of Research and Development in the Subject

6. Significance of the study

7. Objectives

8. Plan of research work

M. Sc. Computer Science Part – II: Semester – IV

DSC-VII (DSC19CSC41): Software Project Management

Course Outcomes: Students will able to
CO1: Understand the fundamentals of software project management.
CO2: Study with the different methods and techniques used for project management.
CO3: Understand different techniques of project monitoring, control and review.
CO4: Apply project management practices, tools and risks estimation techniques.

UNIT-I	**Introduction to Project Management** What is Project? What is Project Management?, History of Project Management, Program and Project Portfolio Management, The Role of the Project Manager, Ethics in Project Management, Project Management Software, A Systems View of Project Management, Organizational Structures, Stakeholder Management, Project Phases and the Project Life Cycle, Information Technology Projects, Project Management Process Groups, Mapping the Process Groups to the Knowledge Areas, Developing an Information Technology Project Management Methodology, What Is Project Integration Management?, Strategic Planning and Project Selection, Developing a Project Charter, Developing a Project Management Plan, Directing and Managing Project Execution, Monitoring and Controlling Project Work, Integrated Change Control	**20**
UNIT- II	**Project Scope, Time, Cost and Quality Management** What Is Project Scope Management?, Collecting Requirements, Defining Scope, Work Breakdown Structure, Verifying and Controlling Scope, The Importance of Project Schedules, Defining, Sequencing and Estimating Activities, Developing and Controlling the Schedule, The Importance of Project Cost Management, Principles of Cost Management, Estimating Costs, Determining the Budget, Controlling Costs, The Importance of Project Quality Management, What Is Project Quality Management? , Planning Quality, Performing Quality Assurance, Performing Quality Control, Tools and Techniques for Quality Control, Modern Quality Management	**20**
UNIT- III	**Human Resource, Project Communication, Risk and Procurement Management** What Is Project Human Resource Management?, Keys to Managing People, Developing the Human Resource Plan, Developing the Human Resource Plan, Developing the Project Team, Managing the Project Team, Planning Communications, Distributing Information, Managing Stakeholders, Reporting Performance, Suggestions for Improving Project Communications, Planning Risk Management, Common Sources of Risk, Identifying Risks, Performing Qualitative Risk Analysis, Performing Quantitative Risk Analysis, Planning Risk Responses, Monitoring and Controlling Risks, Planning Procurements, Conducting Procurements, Administering Procurements, Closing Procurements, **Software Metrics**- The scope of software metrics, Size- oriented metrics, Function oriented, Software metrics data collection, Analyzing software data, Measuring size, structure, external attributes, **Software Reliability**-Measurement and prediction, Resource measurement, Productivity, teams and tools, **Quality Standards**-CMM-5 levels, KPA's, PSP/TSP, SIX Sigma	**20**

References:

1. B. Hughes, M. Cotterell, Rajib Mall, Software Project Management, McGraw Hill , 6th Edition
2. R. Walker, Software Project Management, Pearson

3. R. H. Thayer, Software Engineering Project management, IEEE CS Press
4. Software Project Management- A Process- Driven Approach, by Ashfaque Ahmed, CRC press
5. R. Pressman, Software Engineering: A Practitioner's approach, McGraw Hill
6. Project Management and Tools & Technologies – An overview, Shailesh Mehta

DSC-VIII (DSC19CSC42): Natural Language Processing

Course Outcomes: Students will able to

CO1: Understand the automated Natural Language Generation and Machine Translation.
CO2: Explore the student with knowledge of various levels of analysis involved in NLP.
CO3: Analyze the semantic analysis of natural language
CO4: Apply their knowledge for language generation and discourse analysis in the NLP application development.

UNIT-I	**Introduction to NLP** Overview of NLP, Key challenges in NLP (ambiguity, context, language variation), Brief History and Evolution of Natural Language Processing (NLP), Basic Linguistic Concepts, Language Structure (Phonology, Morphology, Semantics), Tokenization, sentence segmentation, and POS tagging, Regular Expressions and Finite-State Automata in NLP, Syntactic Parsing, Dependency Parsing, Probabilistic Parsing Models, Applications of Syntactic Parsing.	**20**
UNIT- II	**Semantic Analysis and Advanced NLP Tasks** Semantic Parsing, Lexical Semantics: Word Meaning and Relations, Synonymy, Antonymy, Hyponymy, Word Sense Disambiguation, Distributional Semantics: Word Embeddings, Word2Vec, and GloVe, Named Entity Recognition (NER) and Linking, Relationship Extraction. The text classification problem, Feature Selection, Naive Bayes text classification, k- nearest neighbors, Support Vector Machine, Flat Clustering, K-means algorithm Hierarchical clustering. Morphology and Part of Speech Tagging, Morphology. Part of speech Tagging - Rule-Based Part of Speech, Tagging, Markov Models - Hidden Markov Models, Viterbi algorithms, Maximum Entropy Models. Sequence Processing with Recurrent Networks, Simple Recurrent Neural Networks Applications of Recurrent Neural Networks, Deep Networks: Stacked and Bidirectional RNNs, Managing Context in RNNs: LSTMs and GRUs, Words, Subwords and Characters.	**20**
UNIT- III	**Semantic Analysis & NLP Applications** Text Parsing: Syntax Parsing, Grammar formalisms and treebanks, Parsing with Context Free Grammars, Features and Unification, Statistical parsing and probabilistic CFGs (PCFGs), Semantic Analysis, Lexical semantics and word-sense, disambiguation, Compositional semantics. NLP Applications: Information Extraction, Introduction to Named, Entity Recognition and Relation Extraction, Question Answering, Text Summarization, Dialog System: Machine Translation.	**20**

References:

1. D. Jurafsky and J. Martin “Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition”, Pearson Education India, 2013.
2. C. Manning and H. Schutze, “Foundations of Statistical Natural Language Processing”, MIT Press, 1999

DSC-IX (DSC19CSC43): Cryptography and Network Security

Course Outcomes: Students will able to

CO1: Provide deep understanding of basics of Cryptography

CO2: Learn and understand various approaches of Encryption and Decryption techniques, strengths of Integrity and Confidentiality

CO3: Understand various protocols for network security to protect against the threats in the networks.

CO4: Apply and design cryptography techniques to secure the communication and work over the network.

UNIT-I	**Cryptography: Concepts and Techniques** Introduction, Plain Text and Cipher Text, Substitution Techniques, Transposition Techniques, Encryption and Decryption, Symmetric and Asymmetric Key Cryptography, Steganography, Key Range and Key Size, Possible Types of Attacks, Cryptanalysis- The Affine Cipher, The Substitution Cipher, The Vigenere Cipher, The Hill Cipher, The Stream Cipher	**20**
UNIT- II	**Symmetric Key Algorithms** Linear Cryptanalysis- Piling-up Lemma, Linear Approximation of S-boxes , Differential Cryptanalysis, Symmetric Key Cryptography, Data Encryption Standards (DES), International Data Encryption Algorithm (IDEA), RC4, RC5, Blowfish, Advanced Encryption Standard (AES) **Hash Functions**-Birthday and Hashing, MD4, MD5 **Asymmetric Key Algorithms** Asymmetric Key Algorithms, RSA algorithm, Symmetric Asymmetric Key Cryptography Together, Digital Signatures, ElGamal Signature Scheme, Variants of ElGamal Signature, Scheme, Knapsack Algorithm	**20**
UNIT- III	**Digital Certificates and Public Key Infrastructure** Digital Certificates, Private Key Management, Challenges and Response in Secret Key Setting, The PKIX model, Public Key Cryptography Standards, Challenges and Response in Public Key Setting, The ElGamal Cryptosystem, The Diffie-Hellman Problem, PKI and Security **User Authentication and Kerberos** Authentication Basics, Passwords, Authentication Tokens, Certificate-based Authentication, Biometric Authentication, Key Distribution Center - Key Pre-distribution, Session Key Distribution Schemes- Kerberos, Re-keying and Logical Key Hierarchy, Security Handshake Pitfalls	**20**

References:

1. Cryptography and Network Security, Atul Kahate, Tata McGraw-Hill
2. Cryptography-Theory and Practice, Douglas R. Stinson, Maura B. Paterson, Fourth Edition, CRC Press
3. Implementing Cryptography using Python, Shanon W. Bray, John Wiley & Sons, Inc.
4. Applied Cryptanalysis, Mark Stamp, Richard M. Low, Wiley-Interscience.

DSE-IV (DSE19CSC41): Remote Sensing and GIS

Course Outcomes: Students will able to

CO1: To know about basic concepts of remote sensing, sensors & types, elements involved, terminology & units energy resources and basic concepts, principles of working, properties of remote sensing.

CO2: Become familiar with the history, characteristics of satellite missions, and recent advancements in remote sensing technology.

CO3: Understand the geographical information system and its fundamental

CO4: Apply the knowledge of RS and GIS in data analysis

UNIT-I	**Concepts and Foundations of Remote Sensing** Introduction, Energy Sources, Electromagnetic Radiation and Spectrum, Radiation Principles (Plank's Law, Stephen Boltezman law) Interaction of EMR with the Earth Surface (Wien's Displacement law, Kirchoffs Law), Types of Remote Sensing and its Advantages, Characteristics of Remote Sensing, Use of different Platforms and Sensors, Elements of Photographic System, Basic Principle of Photogrammetry, Multispectral, Thermal and Hyperspectral Sensing, Earth Remote Satellites, Microwave and Lidar Sensing, Applications of Remote Sensing.	**20**
UNIT- II	**Geographic Information System** Definition and History of GIS, Need for GIS, Components of GIS, Fundamental operations of GIS, Basic Geographic Concepts and Maps, GIS computer Structure Basics, GIS Data Models, GIS Input and Data Storage, GIS query, Measurement, Classification, GIS output and Virtualization.	**20**
UNIT- III	**Overview of Remote Sensing and GIS Development** Introduction, Types of Remote Sensing and GIS software, Installation of Open Source software, Usage, Case Studies of Remote Sensing and GIS, Data sources and Achieves.	**20**

References:

1. Lillesand and Kiefer, "Remote Sensing and Image Interpretation", 7th Edition, published by John Wiley and Sons.
2. Campbell and Wynne, "Introduction to Remote Sensing" 5th Edition, published by the Guilford Press, New York, London.
3. George Joseph and C Jeganathan, "Fundamentals of Remote Sensing", 3rd Edition, published by The Orient Blackswan, 2018
4. Michael N. Demers, Fundamentals of Geographic Information Systems, 3rd Ed, John Wiley & Sons, 1999.
5. Paul A. Longley, Michael F. Goodchild, David J. Maguire, David W. Rhind, "Geographic Information Systems and Science" 2nd Edition, published by Wiley, 2005

DSE-IV (DSE19CSC42): Decision Support Systems

Course Outcomes: Students will able to

CO1: Identify and describe the key components and characteristics of Decision Support Systems (DSS), including the phases of the decision-making process and the subsystems of DSS.

CO2: Explain the traditional system development life cycle and alternative development methodologies for Decision Support Systems, including the significance of prototyping and change management.

CO3: Analyze various approaches to knowledge management and evaluate the effectiveness of different types of expert systems in addressing specific problem areas.

CO4: Design and develop a prototype of a Decision Support System or an expert system for a specific application, incorporating relevant components and methodologies discussed in the course.

UNIT-I	**The Concept of Decision Support Systems** Decision-Making - Phases of the Decision-Making Process, Computerized Decision Support and the Supporting Technologies, A Framework for Decision Support, What Is a DSS, Characteristics and Capabilities of DSS, Components of DSS, The Data Management Subsystem, The Model Management Subsystem, The User Interface (Dialog) Subsystem, The Knowledge-Based Management Subsystem, The User, DSS Hardware, DSS Classifications.	**20**
UNIT- II	**Decision Support System Development** Introduction to DSS Development, The Traditional System Development Life Cycle, Alternative Development Methodologies, Prototyping: The DSS Development Methodology, Change Management, DSS Technology Levels and Tools, DSS Development Platforms, DSS Development Tool Selection, Team-Developed DSS, End User Developed DSS, Putting The DSS Together.	**20**
UNIT- III	**Intelligent Systems** Knowledge Management, Approaches to Knowledge Management, Knowledge Engineering, Basic Concepts of Expert Systems, Applications of Expert Systems, Structure of Expert Systems, How Expert Systems Work, Problem Areas Suitable for Expert Systems, Benefits and Capabilities of Expert Systems, Problems and Limitations of Expert Systems, Expert System Success Factors, Types of Expert Systems, Expert Systems on the Web, Introduction to rule based system, Introduction to Web-Based Intelligent Systems, Expert Systems Development.	**20**

References:

1. Efraim Turban, Jay E Aronson, Ting Peng Liang, Decision Support and Intelligent Systems, Prentice Hall of India, 7th Edition 2005.
2. Clyde W. Holsapple and Andrew B. Whinston, Decision Support Systems,10th Edition, Publication Course Technology Inc. 1996
3. Vicki L. Sauter, Decision Support System for Business Intelligence, 2nd Edition, Publication John Wiley & Sons Inc, 2011.

DSE-IV (DSE19CSC43): Python for Data Analytics

Course Outcomes: Students will able to
CO1: Apply Descriptive Statistics for Data Summarization and Analysis.
CO2: Analyze Correlation and Time Series Data.
CO3: Evaluate Hypothesis Tests and Statistical Inferences.
CO4: Create and Assess Regression Models for Predictive Analysis.

UNIT-I	**Descriptive Statistics** Sampling Techniques, Types of Sampling Techniques – SRSWR and SRSWOR (stratified, Systematic and two stage sampling). Introduction to descriptive statistics, Measures of central tendency, Mean/average, Median, Mode, Measures of dispersion, Calculating percentiles, Quartiles, Standard deviation, Variance, Skewness, Kurtosis, Types of kurtosis, Visualizing Techniques, Types of analysis-Understanding univariate analysis.	**20**
UNIT- II	**Correlation, Regression and Time series** Introducing bivariate data and multivariate data, correlation, understanding bivariate analysis, understanding multivariate analysis, Case study on Correlation and Understanding regression. Types of regression, Simple linear regression, Multiple linear regression, Nonlinear regression, Model development and evaluation, understanding accuracy, constructing a linear regression model, Implementing a multiple linear regression model **Time series** Introduction to Time Series- Fundamentals of TSA, Univariate time series, Characteristics of time series data, Case study on Time series.	**20**
UNIT- III	**Probability distribution and Hypothesis Testing** Distribution function, Cumulative distribution function, Uniform distribution (Discrete and Continues), Normal distribution, Exponential distribution, Binomial distribution, Poison distribution. Introduction to Hypothesis and Hypothesis testing, Hypothesis testing principle, stats models library, Types of hypothesis testing: t-test, ANOVA, Z-test, Chi-square, p-hacking.	**20**

References:

1. Suresh Kumar Mukhiya, Usman Ahmed, "Hands-On Exploratory Data Analysis with Python: Perform EDA techniques to understand, summarize, and investigate your data" Packt publication, 2020
2. Bharti Motwani, "Data Analytics using Python", 2nd edition, Wiley publication,2020
3. Wes McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython", 2nd Edition, Shroff/O'Reilly publication, 2017
4. Joel Grus, "Data Science from Scratch" O'Reilly publication, 2015

RPR-II (RPR19CSC41): Research Project

Research Project based on RPR19CSC41:

1. The student should submit the final bound dissertation/thesis copy of research work carried out during semester III and IV.
2. It should include title page, certificate, declaration, acknowledgement, abbreviations, index, abstract, introduction, experimental section, results and discussion, conclusions, references, participation in conferences/seminars and publications if any.
3. The students should present their work during the evaluation in the form of power point presentation (PPT).

- **Marking Scheme:**

Sr. No.	Description	Marks
1	Dissertation/thesis bound copy	30
2	Quality of work (Innovative concepts, social relevance, extent of work etc.)	50
3	Publications	20
4	Participation in conferences	10 maximum
	a) Oral/Poster Presentation (10 marks)	
	b) Only attended (7 marks)	
5	Final Dissertation/thesis defence	40
	Total	**150**

Note:

1. The Project will be examined jointly by internal (Project Supervisor) and external examiners (preferably Associate professor and above with Ph. D.) at the end of the semester. The project can be given individually or a maximum group of three students is allowed. (Not more than three students allowed).
2. There will be an industrial visit for M.Sc. Part- II Students during the academic year.