

# **Semester - IV**

| Teaching Scheme |   | Semester IV<br>Design and Analysis of Algorithms                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Examination Scheme |    |
|-----------------|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|----|
| TH              | 3 | <b>Course Objectives:</b><br>1. Explain fundamental algorithm design, analysis, and performance evaluation concepts using asymptotic notations and recurrence solving techniques.<br>2. Solve computational problems by applying algorithmic paradigms such as divide-and-conquer, greedy, dynamic programming, backtracking, and branch-and-bound.<br>3. Implement algorithms for searching, sorting, shortest path, matrix operations, and combinatorial optimisation, and evaluate their time and space complexity.<br>4. Compare algorithmic strategies for problem-solving and justify the choice of technique based on efficiency and problem constraints.<br>5. Classify problems into complexity classes P, NP, and NP-complete, and apply polynomial-time reductions to analyse computational hardness. | CA                 | 20 |
| PR              | - |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | MSE                | 20 |
| CR              | 3 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | ESE                | 60 |
|                 |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                    |    |

### COURSE CONTENT

| Unit No. | Topic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Hours  |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| 1        | <b>Introduction to Algorithms:</b> Definition, Properties of Algorithms, Expressing Algorithm, Flowchart, Algorithm Design Techniques, Performance Analysis of Algorithms, Types of Algorithms Analysis, Order of Growth, Asymptotic Notations, Recursion, Recurrences Relation, Substitution Method, Iterative Method, Recursion Tree, Master Theorem, Changing Variable, Heap Sort.                                                                                                | 07 Hrs |
| 2        | <b>Divide and Conquer:</b> Introduction, Binary Search, Merge Sort, Quick Sort, Strassen's Matrix Multiplication.                                                                                                                                                                                                                                                                                                                                                                    | 07 Hrs |
| 3        | <b>Backtracking:</b> Backtracking Concept, N-Queens Problem, Four-Queens Problem, Eight-Queen Problem, Hamiltonian Cycle, Sum of Subsets Problem, Graph Coloring Problem, Branch and Bound: Introduction, Traveling Salesperson Problem, 15-Puzzle Problem, Comparisons between Backtracking and Branch and Bound.                                                                                                                                                                   | 07 Hrs |
| 4        | <b>Greedy Algorithms:</b> Introduction to Greedy Technique, Greedy Method, Optimal Merge Patterns, Huffman Coding, Knapsack Problem, Activity Selection Problem, Job Sequencing with Deadline, Minimum Spanning Tree, Single-Source Shortest Path Algorithm.                                                                                                                                                                                                                         | 07 Hrs |
| 5        | <b>Dynamic Programming:</b> Introduction, Characteristics of Dynamic Programming, Component of Dynamic Programming, Comparison of Divide-and-Conquer and Dynamic Programming Techniques, Longest Common Subsequence, matrix multiplication, shortest paths: Bellman-Ford, Floyd Warshall, Application of Dynamic Programming.<br><b>NP Completeness:</b> Introduction, the Complexity Class P, the Complexity Class NP, Polynomial-Time Reduction, the Complexity Class NP-Complete. | 07 Hrs |

**Text Books:**

1. T. Cormen, Introduction to Algorithms, PHI Publication, 4<sup>th</sup> Edition, 2022.

**Reference Books:**

1. Aho, Ullman, Data Structure and Algorithms, Addison-Wesley Publication, 1<sup>st</sup> Edition, 1983.
2. Michel Goodrich, Roberto Tamassia, Algorithm Design – Foundation, Analysis & Internet Examples, Wiley Publication, 2<sup>nd</sup> Edition, 2006.
3. George T. Heineman, Gary Pollice, Stanley Selkow, Algorithms in a Nutshell, A Practical Guide, O'Reilly Media, 2<sup>nd</sup> Edition, 2016.
4. Ellise Horowitz, Sartaj Sahni, S. Rajasekaran, Fundamentals of Computer Algorithms, University Press (India) Private Ltd, 2<sup>nd</sup> Edition, 2008.
5. Sara Base, Computer algorithms: Introduction to Design and Analysis, Addison-Wesley Publication, 2<sup>nd</sup> Edition, 1988.

| Teaching Scheme |   | Semester IV<br>Computer Architecture and Organization                                                                                       | Examination Scheme |    |
|-----------------|---|---------------------------------------------------------------------------------------------------------------------------------------------|--------------------|----|
| TH              | 3 | <b>Course Objectives:</b>                                                                                                                   | CA                 | 20 |
| PR              | - | 1. Explain the structure, function, and interconnection of computer components, including CPU, memory, and I/O systems.                     | MSE                | 20 |
| CR              | 3 | 2. Interpret instruction set architectures, addressing modes, and execution flow, and compare RISC and CISC architectures.                  | ESE                | 60 |
|                 |   | 3. Apply principles of computer arithmetic to perform integer and floating-point operations, and analyse ALU design.                        |                    |    |
|                 |   | 4. Evaluate memory organisation techniques, including cache, virtual memory, and external storage systems, for performance and reliability. |                    |    |
|                 |   | 5. Analyse control unit design, I/O organisation, pipelining, and parallel processing techniques for improving system performance.          |                    |    |

### COURSE CONTENT

| Unit No. | Topic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Hours  |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| 1        | <b>Introduction:</b> Concept of computer organization and architecture, Fundamental unit, Computer function and interconnection, CPU structure and function.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 07 Hrs |
| 2        | <b>Instruction Sets:</b> Characteristics, Types of operands, Types of operations, Assembly language, Addressing modes, Instruction format, Types of instruction, Instruction execution, Machine state and processor status, Structure of program, Introduction to RISC and CISC architecture.                                                                                                                                                                                                                                                                                                                                                         | 07 Hrs |
| 3        | <b>Computer Arithmetic:</b> The arithmetic and logic Unit, Integer representation, Integer arithmetic, Floating point representation, Floating point arithmetic, Introduction of arithmetic co-processor.                                                                                                                                                                                                                                                                                                                                                                                                                                             | 08 Hrs |
| 4        | <b>Memory Organization</b><br><b>Internal Memory:</b> Semiconductor main memory, Error correction, Advanced DRAM organization, Virtual memory systems and cache memory systems.<br><b>External Memory:</b> Organization and characteristics of magnetic disk, Magnetic tape, Optical memory, RAID, Memory controllers.                                                                                                                                                                                                                                                                                                                                | 08 Hrs |
| 5        | <b>Control Unit and Input / Output Organization</b><br><b>Control Unit Operation:</b> Micro-operations, Control of the processor, Hardwired implementation, Micro-programmed Control Unit, Basic concepts, Microinstruction sequencing, Microinstruction execution, Applications of micro-programming.<br><b>Input / Output Organization:</b> External devices, I/O module, Programmed I/O, Interrupt driven I/O, Direct memory access, I/O channels and processors, External interface.<br><b>Instruction Pipe-lining and Parallel processing:</b> Multiple processor organization, Symmetric multiprocessor, Cache coherence and the MESI protocol. | 08 Hrs |

**Text Books:**

1. William Stalling, Computer Organization and Architecture: Designing for Performance, Prentice Hall Publication, 8<sup>th</sup> Edition, 2009.

**Reference Books:**

1. Hayes, Computer Architecture and Organization, McGraw-Hill Publication, 3<sup>rd</sup> Edition, 2012.
2. Zaky, Computer Organization, McGraw-Hill Publication, 5<sup>th</sup> Edition, 2011.
3. Hennessy and Patterson, Computer Architecture: A Quantitative Approach, Morgan and Kaufmann Publication, 4<sup>th</sup> Edition, 2007.
4. Morris Mano, Computer System Architecture, Pearson Education India, 3<sup>rd</sup> Edition, 2007.
5. Mostafa Abd-El-Barr, Hesham El-Rewini, Fundamentals of Computer Organization and Architecture, Wiley Publication, 1<sup>st</sup> Edition, 2004.
6. Miles J. Murdocca, Vincent P. Heuring, Computer Architecture and Organization: An Integrated Approach, Wiley Publication, 1<sup>st</sup> Edition, 2007.
7. Sajjan G. Shiva, Computer Organization: Design, and Architecture, CRC Press, 5<sup>th</sup> Edition, 2013.

| Teaching Scheme |   | Semester IV<br>Probability and Statistics                                                                                                                                                             | Examination Scheme |    |
|-----------------|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|----|
| TH              | 3 | <b>Course Objectives:</b><br>1. To explain basic concepts in statistics and probability.<br>2. To describe various probabilistic distributions.<br>3. To apply regression and correlation techniques. | CA                 | 20 |
| PR              | - |                                                                                                                                                                                                       | MSE                | 20 |
| CR              | 3 |                                                                                                                                                                                                       | ESE                | 60 |

### COURSE CONTENT

| Unit No. | Topic                                                                                                                                                                                                                                                                                                                                                             | Hours  |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| 1        | <b>Probability Theory</b> Definition of probability: classical, empirical, and axiomatic approach of probability, Addition theorem of probability, Multiplication theorem of probability, Bayes' theorem of inverse probability, Properties of probabilities with proofs, Examples.                                                                               | 10 Hrs |
| 2        | <b>Random Variable and Mathematical Expectation:</b> Random variables, Probability distributions, Probability mass function, Probability density function, Mathematical expectation, Joint and marginal probability distributions, Properties of expectation and variance with proofs.                                                                            | 06 Hrs |
| 3        | <b>Theoretical Probability Distributions:</b> Binomial distribution, Poisson distribution, Normal distribution, Fitting of binomial distributions, Properties of binomial, Poisson, and normal distributions, Relation between binomial and normal distributions, Relation between Poisson and normal distributions, Importance of normal distribution, Examples. | 10 Hrs |
| 4        | <b>Correlation:</b> Introduction, Types of correlation, Correlation and causation, Methods of studying correlation, Karl Pearson's correlation coefficient, Spearman's rank correlation, Coefficient, Properties of Karl Pearson's correlation coefficient and Spearman's rank correlation coefficient, Probable errors.                                          | 06 Hrs |
| 5        | <b>Linear Regression Analysis:</b> Introduction, Linear and non-linear regression, Lines of regression, Derivation of regression lines of y on x and x on y, Angle between the regression lines, Coefficients of regression, Theorems on regression coefficient, Properties of regression coefficient.                                                            | 06 Hrs |

#### **Text Books:**

1. S. C. Gupta, Fundamentals of Statistics, Himalaya Publishing House, 7<sup>th</sup> Revised and Enlarged Edition, 2016.
2. G. V. Kumbhojkar; Probability and Random Processes, C. Jamnadas and Co., 14<sup>th</sup> Edition, 2010.
3. Erwin Kreyszig, Advanced Engineering Mathematics, 9<sup>th</sup> Edition, John Wiley & Sons, 2006.

4. Veerarajan T., Engineering Mathematics, Tata McGraw-Hill, New Delhi, 2010.
5. G. Haribaskaran; Probability, Queuing Theory and Reliability Engineering, Laxmi Publications, 2<sup>nd</sup> Edition, 2009.
6. Murray Spiegel, John Schiller, R. ALU Srinivasan, Probability And Statistics, Schaum's Outlines, 4<sup>th</sup> Edition, 2013.

| Teaching Scheme |    | Semester IV<br>Constitution of India                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Examination Scheme |    |
|-----------------|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|----|
| TH              | 2  | <b>Course Objectives:</b><br>1. Explain the historical background, sources, features, and key provisions of the Indian Constitution, including citizenship, fundamental rights, duties, and directive principles.<br>2. Describe the structure, roles, and functions of the Union and State governments, and analyze the relationship between the Centre and States.<br>3. Interpret the organization and functioning of local self-government institutions and evaluate their role in strengthening grassroots democracy.<br>4. Analyze the functions of the Election Commission and other constitutional bodies related to the welfare of marginalized communities and women. | CA                 | 60 |
| PR              | -  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | MSE                | -  |
| CR              | AU |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | ESE                | 40 |
|                 |    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    |    |

### COURSE CONTENT

| Unit No. | Topic                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Hours  |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| 1        | <b>Introduction:</b> Constitution' meaning of the term, Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive, Principles of State Policy.                                                                                                                                                                                                                                                      | 05 Hrs |
| 2        | <b>Union Government and its Administration:</b> Structure of the Indian Union: Federalism, Centre- State, relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha.                                                                                                                                                                                                                           | 05 Hrs |
| 3        | <b>State Government and its Administration</b><br>Governor: Role and Position, CM and Council of Ministers, State Secretariat: Organisation, Structure and Functions.                                                                                                                                                                                                                                                                                                        | 04 Hrs |
| 4        | <b>Local Administration:</b> District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Pachayati Raj: Introduction, PRI: Zila Pachayat, Elected officials and their roles, CEO Zila Pachayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy. | 05 Hrs |
| 5        | <b>Election Commission:</b> Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women.                                                                                                                                                                                                                                 | 05 Hrs |

#### **Text/Reference Books:**

1. Sastry, T. S. N., (2005). India and Human Rights: Reflections, Concept Publishing Company India (P Ltd.).
2. Nirmal, C.J., (1999). Human Rights in India: Historical, Social and Political Perspectives (Law in India), Oxford India.

| Teaching Scheme |   | Semester IV<br>Life of Bharat Ratna Dr. Babasaheb Ambedkar                                                                                              |  | Examination Scheme |    |
|-----------------|---|---------------------------------------------------------------------------------------------------------------------------------------------------------|--|--------------------|----|
| TH              | 1 | <b>Course Objectives:</b>                                                                                                                               |  | CA                 | 50 |
| PR              | - | 1. Analyze the socio-political context of Dr. Ambedkar's era and his role in the Indian freedom struggle and social reform movements.                   |  | MSE                | -  |
| CR              | 1 | 2. Evaluate Dr. Ambedkar's contributions to the framing of the Indian Constitution and his vision for social justice and empowerment.                   |  | ESE                | -  |
|                 |   | 3. Interpret Dr. Ambedkar's views on Marxism, class struggle, and caste, and assess their relevance to contemporary Indian society and economic policy. |  |                    |    |

### COURSE CONTENT

| Unit No. | Topic                                                                                                                                                                                                        | Hours  |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| 1        | Introduction to the socio-political context of Ambedkar's era, British Colonialism, Indian National Movement, Caste Hierarchy, Untouchability, Social Reform Movements, Role in the Indian freedom struggle. | 05 Hrs |
| 2        | Contributions to the Constitution of India, Vision for social justice and empowerment.                                                                                                                       | 05 Hrs |
| 3        | Dr. Ambedkar and Marxism: An Exploration of His Thoughts on Marxism, Common ground with Marxism, Focus on class struggle, Caste vs. Caste, Primacy of Caste in Indian Society, Economic ideas and policies   | 05 Hrs |

| Teaching Scheme | Semester IV                                 |  | Examination Scheme |    |
|-----------------|---------------------------------------------|--|--------------------|----|
|                 | Design and Analysis of Algorithm Laboratory |  |                    |    |
| TH              | -                                           |  | CA                 | 60 |
| PR              | 2                                           |  | MSE                | -  |
| CR              | 1                                           |  | ESE                | 40 |

**List of Experiments:**

1. Implementation of Binary Search.
2. Implementation of finding maximum and minimum numbers using divide and conquer.
3. Implementation of Merge / Quick sort.
4. Implementation of Selection sort.
5. Implementation of Job Sequencing with deadlines.
6. Program for finding the minimum cost Spanning Tree.
7. Implementation of single-source shortest path.
8. Implementation of all-pairs shortest path.
9. Program for Tree traversal techniques.
10. Program for Graph Traversal Technique.

| Teaching Scheme | Semester IV<br>Modern Indian Languages<br>(A) Marathi | Examination Scheme |
|-----------------|-------------------------------------------------------|--------------------|
| TH 2            |                                                       | CA 20              |
| PR -            |                                                       | MSE 20             |
| CR 2            |                                                       | ESE 60             |

**COURSE CONTENT**

| Unit No. | Topic                                                                                                                                                                                                                                                         | Hours  |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| 1        | <b>मराठीचा उगम आणि विकास:</b> मराठीचा उगम आणि विकास, मराठी भाषेवर संत परंपरेचा प्रभाव- ज्ञानेश्वर, तुकाराम, नामदेव आणि एकनाथ यांच्या रचनांचा अभ्यास, मराठीत बखरी लेखन व इतिहास दर्शन, आधुनिक मराठी आणि सुधारणा चळवळी- टिळक, फुले, आणि आगरकर यांचे योगदान.     | 02 Hrs |
| 2        | <b>स्वातंत्र्यानंतरची मराठी भाषा:</b> महाराष्ट्र राज्य निर्मिती व मराठीचा अधिकृत दर्जा, डिजिटल युगातील मराठी भाषा : ब्लॉग, सोशल मीडिया आणि ई-साहित्य, मराठी भाषा संरक्षणासाठी उपाययोजना, शिक्षण व्यवस्थेतील मराठीचा वापर, जागतिक स्तरावर मराठी भाषेचा प्रभाव. | 02 Hrs |
| 3        | <b>मराठी लेखनाचे नियम आवण व्याकरण:</b> संधि, वाक्यप्रकार (विधानार्थी वाक्य, प्रश्नार्थी वाक्य, आज्ञार्थी वाक्य इ.), विरामचिन्हे आणि त्यांचे उपयोग, शुद्धलेखन, समानाधी शब्द (पर्यायवाची शब्द), विरुद्धाधी शब्द.                                                | 02 Hrs |
| 4        | <b>लेखन कौशल्य:</b> लेखन कौशल्याचा परिचय, लेखन कौशल्याचे महत्त्व आणि आवश्यकता ▪ पत्रलेखन ▪ निबंध लेखन ▪ वृत्तलेखन (वृत्तपत्रीय लेखन) ▪ इतिवृत्त लेखन ▪ सारांश लेखन                                                                                            | 02 Hrs |
| 5        | <b>भाषांतर (मराठीतून इंग्रजी आणि इंग्रजीतून मराठी):</b> भाषांतराचा मूलभूत परिचय- भाषांतराची व्याख्या आणि स्वरूप, महत्त्व आणि उपयोग, भाषांतराचे प्रकार इ. ▪ पारिभाषिक शब्दावली, मराठीतून इंग्रजी आणि इंग्रजीतून मराठी भाषांतर.                                 | 02 Hrs |

**Text / Reference Books:**

1. प्रशासनिक लेखन, भाषा संचालनालय, महाराष्ट्र शासन, मुंबई १९६६
2. सुगम मराठी व्याकरण व लेखन - मो.रा. वाळंबे
3. "अनुवाद तसद्धांत आणि प्रयोग" - डॉ. भालचंद्र नेमाडे (लोकवाङ्मय गृह प्रकाशन)
4. मराठी भाषा आणि साहित्याचा इतिहास - वि.का. राजवाडे प्रकाशक : राजवाडे संशोधन मंडळ, धुळे
5. भाषांतर : सिद्धांत आणि प्रयोग - डॉ. अशोक केळकर प्रकाशक : लोकवाङ्मय गृह, मुंबई

| Teaching Scheme | Semester IV<br>Modern Indian Languages<br>(B) Hindi | Examination Scheme |
|-----------------|-----------------------------------------------------|--------------------|
| TH 2            |                                                     | CA 20              |
| PR -            |                                                     | MSE 20             |
| CR 2            |                                                     | ESE 60             |

**COURSE CONTENT**

| Unit No. | Topic                                                                                                                                                                                                                                                                          | Hours  |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| 1        | <b>हिंदी भाषा का उद्भि और स्रोत:</b> ▪ हिंदी भाषा की उत्पत्ति और स्वरूप ▪ संस्कृत, प्राकृत और अपभ्रंश से हिंदी का विकास ▪ हिंदी की प्रमुख बोलियाँ (ब्रज, अवधी, खड़ी बोली, भोजपुरी, राजस्थानी आदी) ▪ हिंदी पर फारसी, अरबी और अंग्रेजी भाषा का प्रभाव.                           | 02 Hrs |
| 2        | <b>स्वातंत्र्योत्तर काल में हिंदी भाषा</b> ▪ प्रशासन, शिक्षा और संचार माध्यमों में हिंदी की भूमिका ▪ राजभाषा के रूप में हिंदी – संवैधानिक स्थिति और व्यावहारिक उपयोग ▪ हिंदी का वैश्विक विस्तार और डिजिटल माध्यमों में हिंदी की उपस्थिति ▪ प्रशासन और संचार माध्यमों में हिंदी | 02 Hrs |
| 3        | <b>हिंदी भाषा लेखन के नियम और व्याकरण</b> ▪ वणिमाला ▪ शब्द-भेद ▪ संधि ▪ वाक्य रचना ▪ वर्तनी ▪ उपसर्ग, प्रत्यय और शब्द निर्माण की प्रक्रिया ▪ विराम चिन्हों का प्रयोग ▪ पर्यायवाची शब्द ▪ विलोम शब्द.                                                                           | 02 Hrs |
| 4        | <b>लेखन कौशल</b> ▪ पत्र लेखन ▪ प्रतिवेदन (रिपोर्ट) लेखन ▪ विज्ञप्ति, नोटिस और परिपत्र लेखन निबंध लेखन ▪ सार लेखन.                                                                                                                                                              | 02 Hrs |
| 5        | <b>अनुवाद (अंग्रेजी से हिंदी और हिंदी से अंग्रेजी)</b><br>अनुवाद : सिद्धांत और परंपरा, अनुवाद : क्षेत्र, प्रकार, पारिभाषिक शब्दावली, अंग्रेजी से हिंदी और हिंदी से अंग्रेजी अनुवाद                                                                                             | 02 Hrs |

**Text / Reference Books:**

1. "हिंदी भाषा का उद्भव और विकास" – डॉ. हरीशचंद्र वर्मा (लोकभारती प्रकाशन)
2. "हिंदी भाषा का इतिहास" – डॉ. रामविलास शर्मा (राजकमल प्रकाशन)
3. "भारत में राजभाषा हिंदी" – डॉ. विश्वनाथ प्रसाद (भारतीय राजभाषा पररषद)
4. "हिंदी व्याकरण और रचना" – डॉ. हरीशचंद्र वर्मा (लोकभारती प्रकाशन)
5. "हिंदी लेखन कौशल" – डॉ. रमेश गुप्ता (सातहत्य भवन)
6. "अनुवाद विज्ञान और सिद्धांत" – डॉ. ओमप्रकाश (राजकमल प्रकाशन)

| Teaching Scheme | Semester IV<br>Modern Indian Languages<br>(C) Sanskrit | Examination Scheme |
|-----------------|--------------------------------------------------------|--------------------|
| TH 2            |                                                        | CA 20              |
| PR -            |                                                        | MSE 20             |
| CR 2            |                                                        | ESE 60             |

**COURSE CONTENT**

| Unit No. | Topic                                                                                                                                                                                                                                                                                                                                                     | Hours  |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| 1        | <b>Introduction to Sanskrit:</b> Importance and history of Sanskrit, Sanskrit alphabets (Varnamala), Swaras (Vowels), Vyanjanas (Consonants), Pronunciation and script (Devanagari).                                                                                                                                                                      | 02 Hrs |
| 2        | <b>Basic Grammar:</b> Nouns, pronouns, Grammatical numbers, Grammatical genders, Grammatical person, Verbs, Tenses, Sandhi (Combination of letters), Karaka (Case system) – Nominative, Accusative, Instrumental, etc., Vibhakti (Declensions of nouns and pronouns), Linga (Gender: Masculine, Feminine, Neuter), Vakya Rachana (Sentence construction). | 02 Hrs |
| 3        | <b>Simple Vocabulary and Sentence Formation:</b> Basic words and their meanings (nature, family, animals, objects, etc.), Greetings and basic conversational phrases, Formation of simple sentences                                                                                                                                                       | 02 Hrs |
| 4        | <b>Selected Sanskrit Shlokas and Subhashitas:</b> Recitation and meaning of simple verses from Bhagavad Gita, Hitopadesha, or Panchatantra, Common proverbs (Subhashitas)                                                                                                                                                                                 | 02 Hrs |
| 5        | <b>Reading and Writing Practice:</b> Reading simple Sanskrit texts, Writing small paragraphs in Sanskrit                                                                                                                                                                                                                                                  | 02 Hrs |

| Teaching Scheme |   | Semester IV<br>Python Programming                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Examination Scheme |    |
|-----------------|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|----|
| TH              | 1 | <b>Course Objectives:</b><br>1. Understand algorithms, data structures, and core programming concepts while setting up Python and running your first programs. Work with variables, operations, control flow, functions, strings, and file handling to create interactive and robust applications.<br>2. Apply object-oriented programming principles and efficiently use Python's built-in collections like lists, tuples, sets, and dictionaries.<br>3. Use SQLite and SQL queries to store, retrieve, and manage data, including practical projects like spidering Twitter and joining multiple tables. | CA                 | 60 |
| PR              | 2 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | MSE                | -  |
| CR              | 2 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | ESE                | 40 |

### COURSE CONTENT

| Unit No. | Topic                                                                                                                                                                                                                                                                  | Hours  |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| 1        | Informal introduction to programming, algorithms and data structures, downloading and installing Python, run a simple program on Python interpreter.                                                                                                                   | 02 Hrs |
| 2        | Variables, operations, control flow – assignments, conditionals, loops, functions: optional arguments, default values, passing functions as arguments, Statements, Expressions.<br>Strings: String processing. Exception handling, Basic input/output, handling files. | 02 Hrs |
| 3        | Class and Object, Data Structure: List, Tuple and Sequences, Set, Dictionaries.                                                                                                                                                                                        | 04 Hrs |
| 4        | Using Database and Structured Query Languages (SQL): SQLite manager, Spidering Twitter using a Database, Programming with multiple tables, JOIN to retrieve data.                                                                                                      | 04 Hrs |

#### **Text/Reference Books:**

1. Michael Urban and Joel Murach, Murach's Python Programming, Murach's Publication, 2016
2. Charles Severance, Python for Informatics: Exploring Information, University of Michigan, Version 2.7.0, 2014.
3. Dr. R. Nageswara Rao, Core Python Programming, Dreamtech Press, 1st Edition, 2016.
4. Mark Lutz, Learning Python, O'Reilly Media, 5th Edition, 2013.

5. Mark Pilgrim, Dive into Python 3, A press Publication, 2nd Edition, 2009.
6. Allen B. Downey, Think Python, O'Reilly Media, 2nd Edition, 2012.
7. Jon Kleinberg and Eva Tardos, Algorithm Design, Pearson Education, 1st Edition, 2006.