



॥ वृत्ते ज्ञानान्न मुक्तीः ॥

Dwarka Bahuuddeshiya Gramin Vikas Foundation's

**Rajarshi Shahu College of Engineering, Buldana**

Approved By AICTE New Delhi, NAAC Accredited, Affiliated to Sant Gadge Baba Amravati University



**Department Of Artificial Intelligence & Data Science:**

## **Syllabus-SemIII and SemIV**

- ❖ **Computer Science and Engineering (CS)**
- ❖ **Computer Engineering (KE)**
- ❖ **Artificial Intelligence and Data Science (AIDS)**
- ❖ **Computer Science and Engineering (Data Science) (DS)**

### **SEM III**

**3CS200PC/3DS200PC/3AD200PC/3KE200PC DISCRETE**

**ESTRUCTURE AND GRAPH THEORY**

#### **Course Pre-requisite:**

Basic knowledge of Mathematics

#### **Course Objectives:**

Throughout the course, students will be expected to demonstrate their understanding of Discrete Structure by being able to do each of the following:

- Use mathematically correct terminology and notation.
- Construct correct direct and indirect proofs.
- Apply logical reasoning to solve a variety of problems

#### **Course Outcomes (Expected Outcome):**

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

1. Analyze and express logic sentences in terms of predicates, quantifiers, and logical connectives.
2. Derive the solution for a given problem using deductive logic and prove the solution based on logical inference.
3. Classify algebraic structure for a given mathematical problem.
4. Perform combinatorial analysis to solve counting problems.
5. Perform operation on trees and data structures.
6. Develop the given problem as graph networks and solve with techniques of graph theory

### **Syllabus:**

#### **Unit I: The Foundations: Logic and Proofs (Hours: 07)**

Propositions, Truth Tables, Compound Propositions, Logical Operators, Logic and Bit Operations; Logical Equivalences, Normal Forms, De Morgan's Laws, Satisfiability: Applications and Solving Problems; Predicates, Quantifiers: Restricted Domains, Precedence, Logical Equivalences; Rules of Inference for Propositional Logic.

#### **Unit II: Sets, Functions and Relation (Hours: 07)**

Introduction, Venn Diagrams, Subsets, Size of a Set, Power Sets, Cartesian Products, Set Notation with Quantifiers, Truth Sets and Quantifiers, Set Operations, Functions, Inverse

Functions, Compositions and Graphs of Functions, Partial Functions; Sequences, Summations; Countable Sets, An Uncountable Set; Functions as Relations, Relations on a Set, Properties of Relations, Combining Relations; Representing Relations Using Matrices; Representing Relations, Closures of Relations, Equivalence Relations.

### **Unit III: Algebraic Structures (Hours: 07)**

Algebraic Systems: Examples and General Properties; Semigroups and Monoids: Homomorphism of Semigroups and Monoids, Subsemigroups and Submonoids; Groups: Definitions, Subgroups and Homomorphisms, Cosets and Lagrange's Theorem, Normal Subgroups, algebraic Systems with Two Binary Operations; Group Codes: The Communication Model and Basic Notions of Error Correction, Hamming Distance.

### **Unit IV: Boolean Algebra (Hours: 07)**

Lattices, Boolean Algebra: Boolean Functions, Representing Boolean Functions, sum of product expansions, Product of sum expansion, Functional Completeness, Logic Gates, Combinations of Gate, Minimization of Circuits, Karnaugh Maps.

### **Unit V: Tree (Hours: 07)**

Introduction, Rooted Tree, ordered rooted tree, tree as model, Properties of Trees, Applications of tree, Binary Search Trees, Decision Trees, Prefix Codes, Huffman Coding, Game Trees, Tree traversal, Preorder Traversing, Inorder Traversing, Post order Traversing, Spanning Tree, Minimum spanning tree

### **Unit VI: Graph (Hours: 07)**

Graph Models; Basic Terminology, Special Simple Graphs, Bipartite Graphs, Matchings, Applications of Special Types of Graphs, New Graphs from Old; Graph Representation, Adjacency and Incidence Matrices, Isomorphism of Graphs, Determining Isomorphism; Paths, Connectedness in Undirected Graphs and Directed Graphs, Paths and Isomorphism, Counting Paths Between Vertices; Euler Paths and Circuits, Hamilton Paths and Circuits, Applications of Hamilton Circuits; Planar Graphs: Euler's Formula, Kuratowski's Theorem; Graph Coloring: Introduction, Applications of Graph Coloring

### **Text Books:**

1. Kenneth H. Rosen: Discrete Mathematics and Its Applications, 7th Edition, McGraw-Hill.
2. J. P. Tremblay and R. Manohar: Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw-Hill Edition, McGraw-Hill.

### **Reference Books:**

1. Norman L. Biggs: Discrete Mathematics, 2nd Edition, Oxford University Press.
2. Seymour Lipschutz and Marc Lars Lipson: Schaum's Outline of Theory and Problems of Discrete Mathematics, 3rd Edition, Schaum's Outlines Series, McGraw-Hill.
3. C. L. Liu and D. P. Mohapatra: Elements of Discrete Mathematics: A Computer Oriented Approach, 3rd Edition, Tata McGraw-Hill, McGraw-Hill.

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**3CS201PC/3AD201PC**  
**OBJECTORIENTEDPROGRAMMIN**  
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**CoursePrerequisite:**

ComputerProgramming

**CourseObjectives:**

Throughoutthe course, students will be expected to demonstrate their understanding:

- To explore the principles of Object Oriented Programming (OOP) such as data abstraction, encapsulation, inheritance and polymorphism.
- To use the object-oriented paradigm in program design.
- To provide programming insight using OOP constructs.
- To lay a foundation for advanced programming

**CourseOutcomes(ExpectedOutcome):**

On completion of the course, the students will be able to

1. Apply Object Oriented approach to design software.
2. Implement programs using classes and objects.
3. Specify the forms of inheritance and use them in programs.
4. Analyze polymorphic behavior of objects.
5. Design and develop GUI programs.
6. Develop Applets for web applications

**Syllabus:**

**UnitI:IntroductiontoObjectOrientedProgramming:(Hours:07)**

Introduction, Need of OOP, Principles of Object-Oriented Languages, Procedural Language Vs OOP, Application of OOP, Java Virtual Machine, Java features, Program Structures. Java Programming Constructs: Variables, Primitive data types, Identifier, Literals, Operators, Expressions, Precedence Rules and Associativity, Primitive Type Conversion and Casting, Flow of Control.

**UnitII:ClassesandObjects:(Hours:07)**

Classes, Objects, Creating Objects, Methods, Constructors, Cleaning up Unused Objects, Class Variable and Methods, this keyword, Arrays, Command Line Arguments.

**UnitIII:Inheritance,InterfacesandPackages:(Hours:07)**

Inheritance: Inheritance vs. Aggregation, Method Overriding, super keyword, final keyword, Abstract class. Interfaces: Defining interfaces, Implementing interfaces, Accessing interface variables, Extending interfaces. Packages: Packages, java.lang package

**UnitIV:ExceptionhandlingandInput/Output:(Hours:07)**

Exception: Introduction, Exception handling Techniques, User-defined exception, Exception Encapsulation and Enrichment. Input/Output: The java.io.file Class, Reading

and Writing data, Randomly Accessing a file, Reading and Writing Files using I/O Package.

#### **UnitV:Applets:(Hours:07)**

Introduction,AppletClass,Appletstructure,AppletLifecycle,CommonMethodsused in displaying the output, paint (), update () and repaint (), More about applet tag, getDocumentBase() and getCodeBase () methods, Applet Context Interface, Audio clip, GraphicClass, Color,Font,FontMetrics.

#### **UnitVI:EventHandling:(Hours:07)**

Introduction,EventdelegationModel,java.awt.eventDescription,Sourcesofevents, EventListeners,Adapterclasses,InnerClasses.AbstractWindowToolkit:Introduction, Components and Containers, Button, Label, Checkbox, Radio Buttons, List Boxes, ChoiceBoxes,TextfieldandTextarea,ContainerClass,Layouts,Menu,Scrollbar.

#### **TextBooks:**

1. SachinMalhotraandSaurabhChoudhary:ProgramminginJava,OxfordUniversity Press2010.
2. HerbertSchildt:JavaCompleteReferences(McGrawHill)

#### **ReferenceBooks:**

1. H.M.DietelandP.J.Dietel, “JavaHowtoProgram”PearsonEducation/PHI,Sixth Edition.
2. E.Balagurusamy:ProgrammingwithJava(McGrawHill)
3. Dr.R.NageswaraRao:CoreJavaAnIntegratedApproach(Dreamtech)
4. KhalidMughal:AProgrammer’sGuidetoJavaCertification,3rdEdition(Pearson)
5. SharnamShahandVaishaliShah:CoreJavaforBeginners,(SPD),2010.

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**3DS201PC/3KE201PC**

### **PROGRAMMINGMETHODOLOGYUSINGPYTHON**

#### **CoursePre-requisites:**

BasicKnowledgeofProgrammingfundamentals

#### **CourseObjective:**

Throughoutthecourse,studentswillbeexpectedtodemonstratetheirunderstandingof: ProgrammingMethodologyUsingPythonbybeingabletodoeachofthefollowing:

- DescribethecoresyntaxandsemanticsofPythonprogramminglanguage.
- Discovertheneedforworkingwiththestringsandfunctions.
- Illustratetheprocessofstructuringthedatausinglists,dictionaries,tuplesandsets.
- Indicatetheuseofmodules,packagesand built-infunctionstonavigatethefile system.
- InfertheObject-orientedProgrammingconcepts inPython.
- TodeveloptheabilitytowritedatabaseapplicationsinPython.

**Course Outcomes:**

On completion of the course, the students will be able to

1. Apply various fundamentals for problem solving using python
2. Develop proficiency in creating applications using the Python programming Language.
3. Understand the various data structures available in Python programming language and apply them in solving computational problems.
4. Draw various kinds of plots.

**Syllabus:****Unit I: Introduction: (Hours: 07)**

Basic concepts of Python- Variables, Data Types, Operators: Arithmetic, Logical, Relational, Conditional Statements: if, if-else, elif, Looping Statements: for, while, Control Statements: break, continue, pass.

**Unit II: Strings and Functions: (Hours: 07)**

String Manipulation- Accessing Strings- Basic Operations- String slices- Function and Methods Functions Defining a function- Calling a function- Types of functions Function Arguments- Anonymous functions- Global and local variables

**Unit III: Data Structures in Python: (08 Hrs)**

Lists- Introduction - Accessing list - Operations - Working with lists - Function and Method Tuple- Introduction Accessing- Tuples- Operations- Working- Functions and Methods Dictionaries - Introduction - Accessing values in dictionaries - Working with dictionaries Properties - Functions.

**Unit IV: Classes and Objects: (Hours: 07)**

Overview of OOP, Class Definition, Creating Objects, Objects as Arguments, Objects as Return Values, Built-in Class Attributes, Inheritance- Overloading- Overriding- Data hiding.

**Unit V: Modules and Packages: (Hours: 07)**

Standard modules- Importing own module as well as external modules Understanding Packages, Powerful Lambda function in python Programming using functions, modules and external packages.

**Unit VI: Working with Data in Python: (Hours: 07)**

Printing on screen- Reading data from keyboard- Opening and closing file- Reading and writing files Functions Loading Data with Pandas- Numpy

**Text Book:**

Martin C Brown, "Python: The Complete Reference", McGraw Hill

**Reference Books:**

1. Larry Lutz, "Python for Beginners: Step-By-Step Guide to Learning Python Programming", CreateSpace Independent Publishing Platform, First edition, ISBN-1717410588, 9781717410580, 2018
2. Nicholas Ayden, "Python Programming", Independently Published, First Edition, ISBN-1707051933, 9781707051939, 2019.
3. Michał Jaworski, Tarek Ziadé, "Expert Python Programming", Packt Publishing Ltd., Third Edition, ISBN-9781789808896, 2019.

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**3CS202PC/3DS202PC/3AD202PC/3KE202PCDA**

### **TA STRUCTURES**

**Course Pre-requisite:**

Fundamentals of programming Language C Logic Building Skills

**Course Objectives:**

- To understand the linear and non-linear data structures and its memory representations.
- To perform different operations on data structures such as insertion, deletion, searching and traversing.
- To understand various data searching and sorting methods with its complexity.
- To introduce various techniques for representation of the data in the real world.

**Course Outcomes:**

On completion of the course, the students will be able to

1. Apply various linear and non-linear data structures
2. Demonstrate operations like insertion, deletion, searching and traversing on various data structures
3. Examine the usage of various structures in approaching the problem solution.
4. Choose appropriate data structure for specified problem domain

**Syllabus:**

**Unit I: Introduction to Data Structures: (Hours: 07)**

Introduction to Data structures, Data Structure Operations, Algorithmic Notation, Complexity of algorithms. String processing: storing strings, character datatype, string operations, word processing, and pattern matching algorithms.

**Unit II: Arrays Record Structure: (Hours: 07)**

Linear arrays: Memory Representation of arrays, traversing linear arrays, insertion and deletion operations, Bubble sort, Linear search and Binary search algorithms. Multi-dimensional arrays, Pointer arrays. Record structures.

**Unit III: Linked lists: (Hours: 07)**

LinkedLists:MemoryRepresentationofLinkedList,traversingalinkedlist,searchinga linkedlist.Memory allocation Camp; garbagecollection.Insertion C deletionoperations onlinkedlists.Headerlinkedlists,Two-waylinkedlists.

#### **UnitIV:StacksQueue:(Hours:07)**

Stacks: Sequential Memory Representation of Stack, Arithmetic expressions: Polish notation. Quick sort, Recursion, Tower of Hanoi. Queues: Sequential Memory RepresentationofQueue,DeQueue,Priorityqueues.

#### **UnitV:Trees:(Hours:07)**

IntroductiontoTrees,Binarytrees,MemoryRepresentationofBinaryTree,Traversing binarytrees,Headernodes,BinarySearchTree,Heapandheapsort,PathlengthCamp; Huffman'sal gorithm.

#### **UnitVI:GraphssSortingAlgorithms:(Hours;07)**

Introduction to Graphs, Memory representation of graphs, Warshalls' algorithm, operationsonGraphs,BreadthFirstSearch,DepthFirstSearch.Sorting:InsertionSort, SelectionSort,Radixsort,MergeSort.

#### **TextBooks:**

1. SeymourLipschutz:DataStructures,Schaum'sOutlineSeries,McGraw-Hill,InternationalEditions.
2. Trembley,Sorenson:AnIntroductiontoDataStructureswithApplications,McGraw Hill.

#### **ReferenceBooks:**

1. EllisHorowitz,SartajSahni:FundamentalsofDataStructures,CBSPublications.
2. DataStructureUsingC,Balagurusamy.
3. Standish:DataStructuresinJava,PearsonEducation.

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**3CS400EL /3KE400EL /3DS400EL /3AD400EL**

**COMMUNITY ENGAGEMENT PROJECT / FIELD**

**PROJECT**

**SuggestedActivitiesforCommunityEngagement**

#### **1. DigitalEmpowermentsAwareness**

##### **BridgingtheDigitalDivide:**

- Trainvillageron**mobilebanking**,UPIpayments,andaccessinggovernmente-services (rationcard,Aadhaarupdates,PM-KISAN).
- Conduct**awarenessworkshops**onthe**DigitalIndia**missionandhelplocalsregister for online services.
- Develop**multilingualvideotutorials**ondigitalliteracy,mobilesafety,andsecureonline transactions.
- Providetrainingon**usinggovernmentportals**likeeNAM(NationalAgriculturalMarket) andGeM(Governmente-Marketplace).

##### **SmartVillageInitiative:**

- Setup **public Wi-Fi hotspots** in collaboration with local authorities.
- Assist in **digitizing local businesses**, helping small vendors and farmers list their products online.
- Train rural students in **basic coding and website development** for local business promotion.

## 2. Smart Agriculture Technology Adoption

### Tech-Driven Farming Solutions:

- Develop an **AI-based chatbot** in regional language to assist farmers with crop-related queries.
- Install **IoT-based soil sensors** and educate farmers on precision farming techniques.
- Train farmers in **disease detection using AI-based mobile apps** for plant health monitoring.
- Introduce **solar-powered irrigation systems** to reduce dependency on grid electricity.

### Sustainable Agricultural Practices:

- Conduct **vermicomposting and organic farming workshops** to reduce chemical usage.
- Setup **bio-fertilizer production units** using locally available waste.
- Promote **agroforestry** as a long-term sustainable practice.

## 3. Water Resource Management

### Water Conservation Management:

- Conduct **rainwater harvesting awareness campaigns**.
- Develop a **low-cost water filtration system** for villages facing potable water issues.
- Implement **drip irrigation systems** for water conservation in farming.
- Map and revive **traditional water bodies** in the region.

### Energy-Efficient Practices:

- Promote the use of **solar lamps and bio-gas units** in rural households.
- Conduct workshops on **converting agricultural waste into biomass energy**.

## 4. E-Commerce Rural Entrepreneurship Development

### Market Linkages Skill Development:

- Assist farmers in selling their products on **e-commerce platforms** like Amazon Kisan Store, Flipkart Krishi, and eNAM.
- Conduct training on **branding, packaging, and direct farm-to-market sales strategies**.
- Develop an **online directory of rural artisans** to promote handicrafts through social media.

### Rural Women Empowerment:

- Train rural women in **handicraft-based digital entrepreneurship** (e.g., selling products on Etsy, Meesho).
- Organize workshops on **self-help groups (SHGs)** and micro-financing opportunities.
- Introduce women to **low-cost, home-based business ideas** like making organic soaps, candles, or eco-friendly bags.

## 5. Health & Hygiene Awareness

### Basic Healthcare Services:

- Conduct **free medical check-up camps** with local health professionals.
- Develop an **AI-powered mobile application** to spread verified medical information in local languages.
- Train rural women on **maternal health, child nutrition, and menstrual hygiene management**.

### Sanitation & Waste Management:

- Organize **waste segregation drives** and teach villagers about composting.
- Introduce **biodegradable waste recycling** to generate biogas and organic manure.
- Develop **low-cost water purification units** for households.

## 6. Education & Skill Development

### STEM Awareness Programs:

- Conduct **STEM (Science, Technology, Engineering, and Mathematics) workshops** in rural schools.
- Develop **interactive STEM kits** for students to experiment with physics and engineering principles.
- Train rural students in **3D printing and CAD software** for technical skill enhancement.

### Careers & Competitive Exam Guidance:

- Offer **guidance sessions for competitive exams** like JEE, NEET, UPSC, and MPSC for rural students.
- Organize **spoken English and communications skill development programs**.
- Help students with **resume writing, online job portals, and freelancing opportunities**.

## 7. Cyber Security & Online Safety

### Safe Digital Practices:

- Conduct **cybersecurity awareness workshops** on recognizing fraud, scams, and phishing attacks.
- Train rural youth on **secure online transactions** and social media privacy settings.
- Provide **hands-on training on data encryption and password management**.

## 8. Renewable Energy & Sustainability

### Eco-Friendly Energy Solutions:

- Promote **solar-powered microgrids** for electrification in remote areas.
- Educate villagers on **alternative energy sources** like wind and hydropower.
- Develop and implement **low-cost biogas plants** for households.

### Green Village Initiative:

- Organize **tree plantation drives** in deforested areas.
- Conduct **sustainability workshops** focusing on reducing carbon footprints.

## G. Waste Management & Circular Economy

### **) Plastic-Free Village Campaign:**

- Conduct **awareness programs** on plastic pollution and alternatives.
- Organize **recycling drives** and **upcycling workshops** for students and villagers.
- Train women-led SHGs in **eco-friendly bag and paper product manufacturing**.

### **Q Low-Cost Housing Solutions:**

- Develop a model for **affordable, sustainable housing** using locally available materials.
- Promote the use of **mud bricks, bamboo, and recycled materials** for low-cost homes.

## **10. Smart Infrastructure Community Development**

### **Q Smart Village Concept:**

- Develop a **GIS-based village mapping system** for better resource allocation.
- Set up **community radio stations** to disseminate important information.
- Install **smart lighting solutions** (solar-powered streetlights) for energy efficiency.

### **) Community-Driven Innovation:**

- Encourage students to develop **innovative low-cost solutions** to local problems.
- Facilitate **eco-creation workshops** where villagers and students collaborate on ideas.