Complete Programming Syllabi

Python Programming Syllabus

Module 1: Python Fundamentals

- Introduction to Python and programming concepts
- Installing Python and setting up development environment
- Python syntax, indentation, and code structure
- Variables, data types, and type conversion
- Input/output operations and basic formatting

Module 2: Control Structures and Operations

- Arithmetic, comparison, and logical operators
- Conditional statements (if, elif, else)
- Loops (for, while) and loop control statements
- Understanding scope and variable lifetime
- Exception handling basics

Module 3: Data Structures

- Lists: creation, indexing, slicing, and methods
- Tuples: immutable sequences and use cases
- Dictionaries: key-value pairs and operations
- Sets: unique collections and set operations
- String manipulation and formatting techniques

Module 4: Functions and Modules

- Defining and calling functions
- Parameters, arguments, and return values
- Local vs global variables and scope
- Lambda functions and functional programming concepts
- Creating and importing modules
- Package management with pip

Module 5: File Handling and I/O

- Opening, reading, and writing files
- File modes and context managers
- Working with CSV and JSON data
- Directory operations and path handling
- Error handling in file operations

Module 6: Object-Oriented Programming

- Classes and objects fundamentals
- Attributes and methods
- Constructors and destructors
- Inheritance and method overriding
- Encapsulation and polymorphism
- Special methods and operator overloading

Module 7: Advanced Python Concepts

- Decorators and their applications

- Generators and iterators
- Context managers and the 'with' statement
- Regular expressions for pattern matching
- Working with dates and times

Module 8: Libraries and Frameworks

- NumPy for numerical computing
- Pandas for data manipulation
- Matplotlib for data visualization
- Requests library for HTTP operations
- Introduction to web scraping with BeautifulSoup

Module 9: Testing and Debugging

- Unit testing with unittest module
- Debugging techniques and tools
- Code profiling and optimization
- Best practices for code quality
- Documentation and commenting standards

Django Web Framework Syllabus

Module 1: Django Introduction and Setup

- Understanding web development and MVC architecture
- Django framework overview and philosophy

- Installing Django and project setup
- Understanding Django project structure
- Virtual environments and dependency management

Module 2: Django Fundamentals

- Creating Django applications
- URL configuration and routing
- Views: function-based and class-based
- Templates and template inheritance
- Static files management
- Django admin interface basics

Module 3: Models and Database Integration

- Django ORM fundamentals
- Model definition and field types
- Database migrations and schema management
- QuerySet API and database operations
- Model relationships (OneToOne, ForeignKey, ManyToMany)
- Custom model methods and properties

Module 4: Advanced Models and Database Operations

- Model inheritance strategies
- Database indexing and optimization
- Custom managers and QuerySets
- Database transactions

- Raw SQL queries when necessary
- Database backend configuration

Module 5: Views and URL Patterns

- Function-based views in detail
- Class-based views and mixins
- Generic views for common patterns
- URL namespacing and reverse URL lookup
- Handling different HTTP methods
- View decorators and middleware

Module 6: Templates and Frontend Integration

- Django template language syntax
- Template filters and tags
- Custom template tags and filters
- Template inheritance and inclusion
- Integrating CSS frameworks
- JavaScript integration strategies

Module 7: Forms and User Input

- Django forms framework
- Form validation and error handling
- ModelForms for database integration
- Formsets for multiple forms
- File uploads and media handling

- CSRF protection and security

Module 8: User Authentication and Authorization

- Django authentication system
- User registration and login/logout
- Password management and reset
- User profiles and custom user models
- Permissions and groups
- Decorators for access control

Module 9: Advanced Django Features

- Django REST framework basics
- API development and serialization
- Caching strategies and implementation
- Internationalization and localization
- Email integration
- Custom management commands

Module 10: Testing and Deployment

- Unit testing Django applications
- Integration testing and test databases
- Test-driven development practices
- Deployment preparation and settings management
- Production deployment strategies
- Performance monitoring and optimization

C++ Programming Syllabus

Module 1: C++ Fundamentals

- Introduction to C++ and its history
- Setting up development environment (IDE/compiler)
- Basic program structure and compilation process
- Variables, constants, and data types
- Input/output with iostream library
- Comments and code documentation

Module 2: Operators and Control Flow

- Arithmetic, relational, and logical operators
- Bitwise and assignment operators
- Conditional statements (if, switch)
- Looping constructs (for, while, do-while)
- Break, continue, and goto statements
- Operator precedence and associativity

Module 3: Functions and Program Structure

- Function declaration and definition
- Function parameters and return types
- Function overloading
- Default parameters and inline functions
- Recursion and recursive algorithms

- Scope and storage classes
- Header files and separate compilation

Module 4: Arrays and Strings

- One-dimensional and multi-dimensional arrays
- Array initialization and manipulation
- C-style strings and string functions
- Introduction to C++ string class
- Character arrays vs string objects
- Dynamic memory allocation for arrays

Module 5: Pointers and References

- Understanding memory addresses
- Pointer declaration and initialization
- Pointer arithmetic and array-pointer relationship
- References and their differences from pointers
- Passing by value, reference, and pointer
- Dynamic memory allocation (new/delete)

Module 6: Object-Oriented Programming Basics

- Classes and objects concept
- Data members and member functions
- Constructors and destructors
- Access specifiers (private, public, protected)
- Static members and functions

- Friend functions and classes

Module 7: Advanced OOP Concepts

- Inheritance and types of inheritance
- Function overriding and virtual functions
- Polymorphism and virtual destructors
- Abstract classes and pure virtual functions
- Multiple inheritance and virtual inheritance
- Operator overloading

Module 8: Memory Management and Advanced Features

- Dynamic memory management best practices
- Copy constructors and assignment operators
- Move semantics and rvalue references
- Smart pointers (unique_ptr, shared_ptr)
- Exception handling (try, catch, throw)
- Namespaces and scope resolution

Module 9: Standard Template Library (STL)

- Introduction to templates
- STL containers (vector, list, map, set)
- STL iterators and their categories
- STL algorithms and function objects
- String processing with STL
- Custom comparators and functors

Module 10: Advanced C++ Topics

- Template specialization and metaprogramming
- Lambda expressions and closures
- File I/O and stream manipulation
- Multithreading basics with std::thread
- Modern C++ features (C++11/14/17/20)
- Best practices and code optimization

Module 11: Data Structures and Algorithms

- Implementing common data structures
- Linked lists, stacks, and queues
- Trees and binary search trees
- Hash tables and collision resolution
- Graph representations and algorithms
- Sorting and searching algorithms

Module 12: Project Development and Best Practices

- Software design principles
- Code organization and project structure
- Debugging techniques and tools
- Unit testing frameworks
- Version control integration
- Performance profiling and optimization
- Code review and documentation standards