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• Introduction  
 o Implication and Scope of Java and Advanced Java Programming concepts and its Importance in Economic growth of Nation  
 o Impact of the course on Societal Problems / Sustainable Solutions / National Economy  
 o Career Perspective  
 o Overview of the course in current Innovations and Research Trends  
• Java Programming Fundamentals  
 o Introducing Data Types and Operators  
 o Program Control Statements  
 o Introducing Classes, Objects and Methods  
• Methods, Classes and Inheritance  
 o Controlling Access to Class Members  
 o Pass Objects to Methods  
 o How Arguments are passed  
 o Returning Objects  
 o Method Overloading  
 o Overloading Constructors  
 o Recursion  
 o Constructors and Inheritance  
 o using super to Call Superclass constructors  
 o using super to Access Superclass Members  
 o creating a Multilevel Hierarchy  
 o Superclass References and Subclass Objects  
 o Method Overriding  
 o Overridden Methods  
 o Polymorphism  
 o Using Abstract Classes  
 o Using final  
• Interfaces, Packages, and Exception Handling  
 o Interface Fundamentals  
 o Creating an Interface  
 o Implementing an Interface  
 o Using Interface References  
 o Implementing Multiple Interfaces  
 o Constants in Interfaces  
 o Interfaces can be extended  
 o Nested Interfaces  
 o Package Fundamentals  
 o Packages and Member Access  
 o Importing Packages  
 o The Exception Hierarchy  
 o Exception Handling Fundamentals  
 o The Consequences of an Uncaught Exception  
 o Exceptions Enable you to handle errors gracefully  
 o using Multiple catch clauses  
 o Catching subclass Exceptions  
 o Throwing an Exception  
 o Throwable  
 o using finally  
 o using throws  
• Multithreaded Programming and Enumerations  
 o Multithreading fundamentals  
 o The Thread Class and Runnable Interface  
 o Creating Thread  
 o Creating Multiple Threads  
 o Determining When a Thread Ends  
 o Thread Priorities  
 o Synchronization  
 o using Synchronization Methods  
 o The Synchronized Statement  
 o Thread Communication using notify(), wait() and notify All()  
 o suspending, Resuming and stopping Threads  
 o Enumerations  
 o The Values() and Valueof() Methods  
 o Instance variables and enumerations  
• Servlets  
 o Servlet Structure  
 o Packaging  
 o Lifecycle  
 o HTTP Request and response  
 o Handling client request  
 o Form data  
 o HTTP status request headers  
 o HTTP Status codes  
 o HTTP response headers  
 o Handling cookies  
 o Session tracking  
• Java Server Pages  
 o Need of JSP  
 o Basic syntax  
 o Scripting elements  
 o Limiting Java code in JSP  
 o JSP expression  
 o JSP directives  
 o JSP attributes  
• JDBC  
 o Steps to connect to the database  
 o Connectivity with Oracle or MySQL  
 o DriverManager  
 o Connection  
 o Statement  
 o ResultSet interfaces  
 o PreparedStatement  
 o ResultSetMetaData  
 o DatabaseMetaData  
• Server Side Component Types  
 o The Stateless Session Bean  
 o the Stateful Session Bean  
 o the Singleton Session Bean  
 o Message Driven Bean  
 o Entity Bean  
• Recap  
 o Summary of Java and Advanced Java Programming concepts

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• Introduction of Java  
 o Byte code  
 o Java characteristics  
 o Overview of Java-Object-Oriented Programming  
 o Example programs  
• Data types, Variables and Arrays  
 o Primitive types  
 o Variables  
 o Arrays  
• Control statements  
 o Selection statements  
 o Iteration statements  
 o Jump statements  
• Introducing classes  
 o Class fundamentals  
 o Declaring objects  
 o Introducing methods  
 o Constructors  
 o This keyword  
 o Garbage collection  
• A Closer Look at Methods and Classes  
 o Overloading methods  
 o Using objects as parameters  
 o Argument passing  
 o Returning objects  
 o Introducing access control  
 o Understanding static  
 o Introducing final  
 o Arrays revisited  
 o Command Line Arguments  
• Inheritance  
 o Inheritance basics  
 o Using super  
 o Multilevel hierarchy  
 o Dynamic method dispatch  
 o Using Abstract class  
 o Using final with Inheritance  
• Packages  
 o Defining a package  
 o Finding packages and class path  
 o Example  
 o Access Protection  
 o Importing Packages  
• Interfaces  
 o Defining interface  
 o Implementing interface  
 o Nested interfaces  
 o Applying interfaces  
 o Variables in interfaces  
 o Interfaces can be extended  
• I/O Basics  
 o Streams-byte streams and character streams  
 o Predefined streams  
 o Reading console input  
 o Reading characters  
 o Reading strings  
 o Writing console output  
 o Reading and Writing files  
• String handling  
 o String constructors  
 o Special string operations  
 o Character extraction  
 o String comparison  
 o Searching strings  
 o Modifying a string  
 o String buffer  
 o Additional string buffer methods  
• Enumeration  
 o Enumeration fundamentals  
 o Value() and valueOf() methods  
 o Java enums are class types  
• Exception handling  
 o Fundamentals  
 o Exception types  
 o Uncaught exceptions  
 o Using try and catch  
 o Multiple catch clauses  
 o Nested try statements  
 o Throw, throws, finally  
 o Java’s built-in exceptions  
 o Creating your own exception subclasses  
• Multithreaded Programming  
 o Introduction to process  
 o Difference between process and threads  
 o Java thread model  
 o Main thread  
 o Creating thread  
 o Creating multiple threads  
 o Using isAlive() and join()  
 o Thread priorities  
 o Synchronization  
• The History and Evolution of Java  
 o The Byte code  
 o Features of Java  
 o An overview of Java: Object-Oriented Programming  
 o Structure of a Java program  
• Data Types, Variables and Arrays  
 o The Primitive Types  
 o Integers  
 o Floating Point Types  
 o Characters  
 o Booleans  
 o Variables  
 o Type conversion and casting  
 o Arrays  
• Classes  
 o Fundamentals  
 o Declaring Objects  
 o Assigning Object Reference Variables  
 o Methods  
 o Constructors  
 o This Keyword  
 o Garbage Collection  
 o Stack application  
• Methods and Classes  
 o Overloading Methods  
 o Using Objects as Parameters  
 o Argument Passing  
 o Returning Objects  
 o Access Control  
 o Static  
 o Final  
 o Command-Line Arguments  
• Inheritance  
 o Basic concepts  
 o Member Access and Inheritance  
 o Practical Example  
 o Inheritance types  
 o Super  
 o Constructors  
 o Method Overriding  
 o Dynamic Method Dispatch  
 o Abstract Classes  
 o Final with inheritance  
• String Handling  
 o String Constructor  
 o String length  
 o Special string Operations  
 o Character Extraction  
 o String comparison  
 o Modifying a string  
 o String Buffer  
• Generics  
 o About Generics  
 o A simple Generic Example  
 o General class with Two Type Parameters  
 o General form of generic class  
• Packages and Interfaces  
 o Packages  
 o Packages and member access  
 o Importing packages  
 o Interfaces  
 o Default interface methods  
 o Use static methods in an interface  
 o Private Interface methods  
• Exception handling  
 o Fundamentals  
 o Exception types  
 o Uncaught exceptions  
 o Try and catch  
 o Multiple catch clauses  
 o Nested try statements  
 o Throw, throws, finally  
 o Java’s built-in exceptions  
 o User-defined exceptions  
• Multithreaded Programming  
 o Java thread model  
 o Main thread  
 o Creating thread  
 o Creating multiple threads  
 o IsAlive() and Join()  
 o Thread priorities  
 o Synchronization  
• Input/Output  
 o Exploring java.io  
 o The I/O Classes and Interfaces  
 o The Byte Streams  
• Event Handling  
 o Two Event Handling Mechanisms  
 o The Delegation Event Model  
 o Events - Event Sources  
 o Event Listeners  
 o Event Classes - The MouseEventClass  
 o Event Listener Interfaces-The MouseListener Interface  
 o The MouseMotionListener Interface  
 o Delegation Event Model – Handling Mouse Events  
• AWT  
 o Working with Windows, Graphics and Text  
 o AWT Classes  
 o Window Fundamentals  
 o Working with Frame Windows  
 o Graphics

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• Principle of Programming Languages  
 o Overview of different programming paradigms  
 o Syntax and semantics of programming languages  
 o Names, their scope, life and binding  
 o Control-flow, control abstraction  
 o Primitive and constructed data types  
 o Data abstraction, inheritance, type checking, and polymorphism  
 o Typed-calculus, higher order functions and types  
 o Evaluation strategies, type checking, implementation  
 o Computing with relation, first-order logic, SLD-resolution, unification  
 o Communication and synchronization, shared memory and message passing  
 o Safety and liveness properties, multithreaded program  
 o Operational, denotational and axiomatic semantics  
 o Semantics of nondeterminism and concurrency  
  
• Compiler Design  
 o Overview and Phases of compilation  
 o Lexical Analysis: NFA & DFA, Regular grammar, Regular expressions and Regular languages  
 o Design of a Lexical Analyzer as a DFA, Lexical Analyzer generator  
 o Syntax Analysis: Role of a Parser, Context free grammars and Context free languages  
 o Parse trees and derivations, Ambiguous grammar  
 o Top Down Parsing: Recursive descent parsing, LL (1) grammars, Non-recursive Predictive Parsing  
 o Error reporting and Recovery  
 o Bottom Up Parsing: Handle pruning and shift reduces Parsing, SLR parsers and construction or SLR parsing tables  
 o LR(1) parsers and construction of LR(1) parsing tables, LALR parsers and construction of efficient LALR parsing tables  
 o Parsing using Ambiguous grammars, Error reporting and Recovery, Parser generator  
 o Intermediate Code Generation: DAG for expressions, Three address codes - Quadruples and Triples  
 o Types and declarations, Translation of Expressions, Array references, Type checking and Conversions  
 o Translation of Boolean expressions and control flow statements, Back Patching  
 o Intermediate Code Generation for Procedures  
 o Code Generation: Factors involved, Registers allocation, Simple code generation using STACK Allocation  
 o Basic blocks and flow graphs, Simple code generation using flow graphs  
 o Code Optimization: Objective, Peephole Optimization  
 o Concepts of Elimination of local common sub-expressions, Redundant and un-reachable codes  
 o Basics of flow of control optimization  
 o Run Time Environment: Storage Organizations, Static and Dynamic Storage Allocations, STACK Allocation  
 o Handlings of activation records for calling sequences  
 o Syntax Directed Translation: Syntax Directed Definitions (SDD), Inherited and Synthesized Attributes  
 o Dependency graphs, Evaluation orders for SDD, Semantic rules, Application of Syntax Directed Translation  
 o Symbol Table: Structure and features of symbol tables, symbol attributes and scopes  
  
• Computer Organization and Architecture  
 o Functional blocks of a computer: CPU, memory, input-output subsystems, control unit  
 o Instruction set architecture of a CPU –registers, instruction execution cycle, RTL interpretation of instructions  
 o Addressing modes, instruction set  
 o Data representation: signed number representation, fixed and floating point representations, character representation  
 o Computer arithmetic – integer addition and subtraction, ripple carry adder, carry look-ahead adder  
 o Multiplication – shift-and-add, Booth multiplier, carry save multiplier  
 o Division restoring and non-restoring techniques, floating point arithmetic  
 o Introduction to x86 architecture  
 o CPU control unit design: hardwired and micro-programmed design approaches  
 o Memory system design: semiconductor memory technologies, memory organization  
 o Peripheral devices and their characteristics: Input-output subsystems, I/O device interface  
 o I/O transfers –program controlled, interrupt driven and DMA  
 o Privileged and non-privileged instructions, software interrupts and exceptions  
 o Programs and processes –role of interrupts in process state transitions, I/O device interfaces – SCII, USB  
 o Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards  
 o Parallel Processors: Introduction to parallel processors, Concurrent access to memory and cache coherency  
 o CPU Basics: Multiple CPUs, Cores, and Hyper-Threading  
 o Introduction to Multiple-Processor Scheduling in Operating System  
 o Memory organization: Memory interleaving, concept of hierarchical memory organization  
 o Cache memory, cache size vs. block size, mapping functions, replacement algorithms, write policies

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• Object-oriented design  
 o Encapsulation and information-hiding  
 o Separation of behavior and implementation  
 o Classes and subclasses  
 o Inheritance  
 o Static and dynamic binding  
 o Polymorphism  
 o Generics and templates  
 o Containers and Collections  
 o Event-handling methods  
 o Exception handling

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• Object Oriented Programming and Web Application using C#  
 o Classes and Objects  
 o Constructors and Destructors  
 o Friend and Virtual Functions  
 o Operator Overloading  
 o Function Overloading  
 o Conversion of Data Types  
 o Inheritance (Single, Hierarchical, Multiple, and Multilevel)  
 o Templates  
 o Exception Handling

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• Fundamentals of Java Programming  
 o Data Types  
 o Variables and Arrays  
 o Operators  
 o Control Statements  
• Java Programming Fundamentals  
 o Features  
 o Data Types  
 o Variables and Arrays  
 o Operators  
 o Control Statements  
 o Class Fundamentals  
 o Declaring Objects  
 o Introducing Methods  
 o Constructors  
 o this keyword  
 o Overloading Methods and Constructors  
 o Static fields and Methods  
 o Nested and Inner classes  
• Classes and Objects  
 o The Nature of an Object  
 o Relationships among Objects  
 o The Nature of a Class  
 o Relationships among Classes  
 o The Interplay of Classes and Objects  
• Inheritance  
 o Inheritance Basics  
 o Using Super  
 o Creating a Multi-Level Hierarchy  
 o Method Overriding  
 o Dynamic Method Dispatch  
 o Using Abstract Classes  
 o Using final with Inheritance  
 o Object Class  
• Packages and Interfaces  
 o Introduction to Packages  
 o Access Protection  
 o Importing Packages  
 o Interfaces  
 o Default Interface Methods  
• Exception Handling  
 o Exception-Handling Fundamentals  
 o Exception Classes  
 o Exception Types  
 o Uncaught Exceptions  
 o Using try and catch  
 o Multiple catch clauses  
 o Nested try Statements  
 o throw, throws, finally  
 o Java’s Built-in Exceptions  
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 o The Java Thread Model  
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 o Creating Multiple Threads  
 o Using isAlive() and join()  
 o Thread Priorities  
 o Synchronization  
 o Interthread Communication  
 o Suspending, Resuming and Stopping Threads  
 o Obtaining a Thread’s State  
• Lambda Expressions  
 o Fundamentals  
 o Block Lambda expressions  
 o Generic Functional Interfaces  
 o Passing Lambda Expressions as Arguments  
 o Lambda Expressions and Exceptions  
• Regular Expressions  
 o Regular Expressions Processing  
• String Handling  
 o The String Constructors  
 o String Length  
 o Special String Operations  
 o Character extraction  
 o String Comparison  
 o Searching Strings  
 o Modifying Strings  
 o Data Conversion Using ValueOf()  
 o Changing the Case of Characters Within a String  
 o Joining Strings  
• Collections  
 o The Collection Interfaces  
 o The Collection Classes  
 o Accessing a Collection via an Iterator  
• JavaFX GUI Programming  
 o Basic Concepts  
 o Application Skeleton  
 o Application Thread  
 o JavaFx Controls  
  Using Buttons and Events  
  Using Image and ImageView  
  Radio Buttons  
  Check Box  
  TextField  
  ScrollPane  
  MenuBasics  
  Menu Bar  
  Menu and MenuItem

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• Complex Series  
 o Power Series  
 o Term by term differentiation  
 o Taylor Series  
 o Laurent Series  
 o Zeros  
 o Singularities  
 o Poles  
 o Essential Singularities  
 o Residue theorem  
 o Evaluation of Integrals