MANIPAL UNIVERSITY JAIPUR

School of Information Security and Data Science

Department of Data Science and Engineering

Course Hand-out

Object Oriented Programming | DSE 2120 | 4 Credits | 3 1 0 4

Session: July- December 2024

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Class: B.Tech. CSE (DSE), Semester, III

A. Introduction:

Object oriented techniques have revolutionized the software development process and are used tremendously in the ITindustry to develop software products of various kinds. The course is designed to give students an in-depth understanding of the basic concepts of object-oriented programming such as encapsulation, inheritance and polymorphism using Java programming language as an aiding tool. The course curriculum and structure has been divided into eight basic modules which cover the programming aspects related with object-oriented domain such asexception handling, multithreading, event handling etc. The course will be taught with the help of several teaching aides such as power point slides and demonstrations of several programming problems using Eclipse/NetBeans tool.

The main objective of the course are as follows:

- To teach students about the basics of classes and objects using Java programming language
- To enable the students to properly use the basic object-oriented pillars such as encapsulation, inheritanceand polymorphism.
- To enable the students to understand the basic difference between a class and an interface.
- To teach students about the implementation aspect of various basic data structures such as Arrays, ArrayListsand Linked List using object-oriented techniques
- To teach students how to provide various types of inheritance and polymorphism using classes and interfaces.
- To introduce students about the role of modern programming constructs such as exceptions in modernprogramming languages

B. Course Outcomes: At the end of the course, students will be able to

[DS 2120.1] Understand the principles of encapsulation and abstraction via objects and classes.

[DS 2120.2] Understand the use of various polymorphic forms using classes and interfaces.

[DS 2120.3] Learn the application of various forms of inheritance in real life programming problems.

[DS 2120.4] Understand the use of advanced programming concepts such as exception handling and multithreading.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

PROGRAM OUTCOMES

[PO.1]. Engineering knowledge: : Apply the knowledge of basic science and fundamental computing in solving complex engineering problems

[PO.2]. Problem analysis: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

[PO.3]. Design/development of Computing solutions: Design solutions for complex IT engineering problems and design system components or processes that meet the specified needs with appropriate

consideration for the Information oriented public health and safety, and the cultural, societal, andenvironmental considerations.

[PO.4]. Conduct investigations of complex problems: Use IT domain research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

[PO.5]. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with anunderstanding of the limitations

[PO.6]. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal,health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice

[PO.7]. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

[PO.8]. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

[PO.9]. Individual and team work: Function effectively as an individual, and as a member or leader in diverseIT teams, and in multidisciplinary settings.

[PO.10]. Communication: Communicate effectively on complex computing engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clearinstructions

[PO.11]. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

PROGRAM SPECIFIC OUTCOMES

The graduation from B.Tech. in Data Science and Engineering will empower the student:

[PSO 1]: To apply creativity in support of the design, simulation, implementation and inference of existing andadvanced technologies.

[PSO 2]: To participate & succeed in IT oriented jobs/competitive examinations that offer inspiring & gratifyingcareers.

[PSO 3]: To recognize the importance of professional development by pursuing postgraduate studies andpositions.

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Term Exam (Close Book)	30
	NPTEL/Coursera Certificate	30
End Term Exam (Summative)	End Term Exam (Close Book)	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

E. SYLLABUS

Introduction: Objects, Classes, Encapsulation, Polymorphism, Inheritance. **Java Basics:** Compilation and Execution of a Java program, Java Compiler and Interpreter, Data Types in Java; **Class Definition and Object Creation**: Instance-Fields/Attributes, Methods, Access Modifiers, Constructors, Object vs Class Variables; Role of static and final keywords in Java, Type Conversion and Promotion. **Polymorphic Forms:** Method Overloading, Objects as Parameters and return types. **Input-Output** : Reading Input and Output in Java. **Object Class in Java** : String form of an Object via toString() method, Object equality method. **Arrays and Strings in Java**: 1-D Arrays, 2-D and multi-dimensional arrays, Variable Size array, Dynamic Arrays using Array Lists, Strings in Java via String, StringBuilder and StringTokenizer classes. **Inheritance in Java:** Extending classes, abstract classes, final classes, Method Overriding, Runtime Polymorphism, Inner Classes – static and non-static nested Classes, Local Classes. **Inheritance via Interfaces**: class vs interface, defining interfaces, implementing multiple inheritance; Comparator and Comparable interfaces, Iterators and List Iterators, Linked Lists. **Exception Handling:** Exceptions, Defining and Creating Exceptions, Use of Exceptions in Real Life Problems. **Package in Java:** Defining and Creating Packages, importing packages. **Garbage Collector**: Role, definition, explicit call. **Multithreading:** Thread class, Runnable interface, thread life cycle, synchronization, thread priority, creating andrunning threads.

F. TEXT BOOKS

- "Java : The Complete Reference", Herbert Schildt, 12th Edition, McGraw Hill, 2022, ISBN-10 : 9355323719, ISBN-13: 978-9355323712.

G. REFERENCE BOOKS

1. "Programming with Java", E Balagurusamy, 6th Edition, McGraw Hill, 2019, ISBN-10: 9353162343, ISBN-13: 978-9353162344.
2. "Object Oriented Programming Through Java", Vishwajeet Barbudhe, 1st Edition, 2020, ISBN-10: 1648690874, ISBN-13: 978-1648690877.

H. Lecture Plan:

I.

S.no.	Topics	Session Outcome	Mode of Delivery	Corresponding CO	Mode of Assessing CO
1	Course Overview	Course Introduction	Power Point Presentation	NA	NA
2	Introduction of Java Programming Language	Java programming Concept	Power Point Presentation	DS 2120.1	NPTEL and Coursera Certification MTE,,ETE
3	Features of Java Programming	Java programming Concept	Power Point Presentation	DS 2120.1	NPTEL and Coursera Certification MTE,,ETE
4	Java Program Structure	Java programming Concept	Power Point Presentation	DS 2120.1	NPTEL and Coursera Certification MTE,,ETE
5	Object Oriented Features: Overview of Encapsulation and Abstraction	Object Oriented Features	Power Point Presentation	DS 2120.1	NPTEL and Coursera Certification MTE,,ETE
6	Object Oriented Features: Introduction of Inheritance and Polymorphism	Object Oriented Features	Power Point Presentation	DS 2120.1	NPTEL and Coursera Certification MTE,,ETE
7	Data Types in Java and Type Conversion	Java programming Concept	Power Point Presentation	DS 2120.1	NPTEL and Coursera Certification MTE,,ETE
8	Basic Concept -Object and Class	Class and Object in Java	Power Point Presentation	DS 2120.1	NPTEL and Coursera

					Certification MTE,,ETE
9	Defining Class and Objects	Class and Object in Java	Power Point Presentation	DS 2120.1	NPTEL and Coursera Certification MTE,,ETE
10	Accessing Class Members and Methods	Object Oriented Features	Power Point Presentation	DS 2120.1	NPTEL and Coursera Certification MTE,,ETE
11	Constructor and Types of constructors	Object Oriented Features	Power Point Presentation	DS 2120.1	NPTEL and Coursera Certification MTE,,ETE
12	Role of Static Keyword in Java	Java programming Concept	Power Point Presentation	DS 2120.1	NPTEL and Coursera Certification MTE,,ETE
13	Role of final keywords in Java	Constructor in Java	Power Point Presentation	DS 2120.1	NPTEL and Coursera Certification MTE,,ETE
14	Reading Input and Output in Java, Input/Output via Scanner Class	Java programming Concept	Power Point Presentation	DS 2120.2	NPTEL and Coursera Certification MTE,,ETE
15	Arrays : 1-D Arrays, 2-D and multi-dimensional arrays	Arrays in Java	Power Point Presentation	DS 2120.2	NPTEL and Coursera Certification MTE,,ETE
16	Variable Size Array	Arrays in Java	Power Point Presentation	DS 2120.2	NPTEL and Coursera Certification MTE,,ETE
17	Dynamic Arrays using Array Lists	Arrays in Java	Power Point Presentation	DS 2120.2	NPTEL and Coursera Certification MTE,,ETE
18	String Handling : Important Functions of String	String in Java	Power Point Presentation	DS 2120.2	NPTEL and Coursera Certification MTE,,ETE
19	StringBuidler and StringTokenizer Classes	String in Java	Power Point Presentation	DS 2120.2	NPTEL and Coursera Certification MTE,,ETE
20	Object Class in Java, toString() Method	Java programming Concept	Power Point Presentation	DS 2120.2	NPTEL and Coursera Certification MTE,,ETE
21	Object Equality Method	Java programming Concept	Power Point Presentation	DS 2120.2	NPTEL and Coursera Certification MTE,,ETE
22	Objects as Parameters and return types	Java programming Concept	Power Point Presentation	DS 2120.2	NPTEL and Coursera Certification MTE,,ETE
23	Introduction of inheritance and It's types, base and derived class concept	Inheritance in Java	Power Point Presentation	DS 2120.3	NPTEL and Coursera Certification MTE,,ETE
24	Inheritance : Extending classes, extend keyword	Inheritance in Java	Power Point Presentation	DS 2120.3	NPTEL and Coursera Certification MTE,,ETE
25	Defining Interface	Interface in Java	Power Point Presentation	DS 2120.3	NPTEL and Coursera Certification MTE,,ETE
26	Inheritance via Interfaces: class vs interface	Interface in Java	Power Point Presentation	DS 2120.3	NPTEL and Coursera Certification MTE,,ETE
27	Extending and Implementing Interface	Interface in Java	Power Point Presentation	DS 2120.3	NPTEL and Coursera Certification MTE,,ETE
28	Interface Object and Nested interface	Interface in Java	Power Point Presentation	DS 2120.3	NPTEL and Coursera Certification MTE,,ETE
29	Implementing multiple inheritance	Interface in Java	Power Point Presentation	DS 2120.3	NPTEL and Coursera Certification MTE,,ETE

30	this keyword in java	Java programming Concept	Power Point Presentation	DS 2120.3	NPTEL and Coursera Certification MTE,,ETE
31	final keyword in java	Java programming Concept	Power Point Presentation	DS 2120.3	NPTEL and Coursera Certification MTE,,ETE
32	Abstract Class and Methos in Java	Java programming Concept	Power Point Presentation	DS 2120.3	NPTEL and Coursera Certification, MTE, ETE
33	Introduction of Polymorphism and It's Types	Polymorphism in Java	Power Point Presentation	DS 2120.3	NPTEL and Coursera Certification. ETE
34	Method Overloading and Constructor Overloading	Polymorphism in Java	Power Point Presentation	DS 2120.3	NPTEL and Coursera Certification. ETE
35	Method Overriding	Polymorphism in Java	Power Point Presentation	DS 2120.3	NPTEL and Coursera Certification. ETE
36	Inner Classes – static and non-static nested Classes	Java programming Concept	Power Point Presentation	DS 2120.3	NPTEL and Coursera Certification. ETE
37	Local Inner Class	Java programming Concept	Power Point Presentation	DS 2120.3	NPTEL and Coursera Certification. ETE
38	Comparator and Comparable Interfaces	user derived classes in Java	Power Point Presentation	DS 2120.3	NPTEL and Coursera Certification. ETE
39	Iterators and List Iterators	Collection Framework in java	Power Point Presentation	DS 2120.3	NPTEL and Coursera Certification. ETE
40	Exception Handling in Java and Types of Exception	Exception Handling in Java	Power Point Presentation	DS 2120.4	NPTEL and Coursera Certification. ETE
41	Exception handling Keywords	Exception Handling in Java	Power Point Presentation	DS 2120.4	NPTEL and Coursera Certification. ETE
42	Defining and Creating Exceptions	Exception Handling in Java	Power Point Presentation	DS 2120.4	NPTEL and Coursera Certification. ETE
43	Use of Exceptions in Real Life Problems	Exception Handling in Java	Power Point Presentation	DS 2120.4	NPTEL and Coursera Certification. ETE
44	Package in Java: Creating, Accessing, Importing and Using Packages	Packages in Java	Power Point Presentation	DS 2120.4	NPTEL and Coursera Certification. ETE
45	Garbage Collector: Role, definition, explicit call;	Role of Garbage Collector	Power Point Presentation	DS 2120.4	NPTEL and Coursera Certification. ETE
46	Multithreading : Thread Class	Multithreading	Power Point Presentation	DS 2120.4	NPTEL and Coursera Certification. ETE
47	Thread life cycle, Thread Priority	Multithreading	Power Point Presentation	DS 2120.4	NPTEL and Coursera Certification. ETE
48	Runnable interface and synchronization	Multithreading	Power Point Presentation	DS 2120.4	NPTEL and Coursera Certification. ETE

J. Course Articulation Matrix: (Mapping of COs with POs)

CO	CO-STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
DS 2120.1	Understand the principles of encapsulation and abstraction via objects and classes.	**2**	**3**	**2**	**2**	**1**	-	-	**1**	**1**	-	-	**1**	**2**	**1**	**1**
DS 2120.2	Understand the use of various polymorphic forms using classes and interfaces.	**2**	**3**	**2**	**2**	**1**	-	-	**1**	**1**	-	-	**1**	**2**	**1**	**1**
DS 2120.3	Learn the application of various forms of inheritance in real life programming problems.	**2**	**3**	**2**	**2**	**1**	-	-	**1**	**1**	-	-	**1**	**3**	**1**	**1**
DS 2120.4	Understand the advanced programming concepts such as exception handling	**2**	**3**	**2**	**2**	**1**	-	-	**1**	**1**	-	-	**1**	**2**	**1**	**1**

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation