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JAVA PROGRAMMING **Course Code : 314317**

Programme Name/s	**: Artificial Intelligence/ Artificial Intelligence and Machine Learning/ Cloud Computing and Big Data/ Computer Technology/ Computer Engineering/ Computer Science & Engineering/ Data Sciences/ Computer Hardware & Maintenance/ Information Technology/ Computer Science & Information Technology/ Computer Science/ Electronics & Computer Engg./**
Programme Code	**: AI/ AN/ BD/ CM/ CO/ CW/ DS/ HA/ IF/ IH/ SE/ TE**
Semester	**: Fourth**
Course Title	**: JAVA PROGRAMMING**
Course Code	**: 314317**

I. RATIONALE

Java is platform independent, open-source object-oriented programming language and used for web applications. Java has the broad industry support and is prerequisite with many allied technologies like Java Server Pages, Android Application Development. This course will enable students to develop applications using java.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Develop standalone and network-based applications using Java.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Develop java program using classes and objects.
- CO2 - Develop java program for implementing code reusability concept.
- CO3 - Develop program to implement multithreading and exception handling.
- CO4 - Develop java program for implementing event handling using window-based application components.
- CO5 - Implements network programming in java.
- CO6 - Develop java program for managing database.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
314317	JAVA PROGRAMMING	JPR	AEC	4	-	4	2	10	5	3	30	70	100	40	25	10	50#	20	25	10	200

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Total IKS Hrs for Sem. : 0 Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Write programs to create classes and objects for the given problem. TLO 1.2 Describe characteristics of the given java token. TLO 1.3 Write program to evaluate given expressions. TLO 1.4 Write programs using relevant control structure to solve the given problem. TLO 1.5 Develop programs using vectors and wrapper classes for the given problem. TLO 1.6 Use constructors for the given programming problem.	**Unit - I Basic Syntactical Constructs in Java** 1.1 Java features and the Java programming environment 1.2 Defining a class, creating object, accessing class members 1.3 Java tokens and data types, symbolic constant, scope of variable, typecasting, and different types of operators and expressions, decision making and looping statements 1.4 Arrays, strings, string buffer classes, vectors, wrapper classes 1.5 Constructors and methods, types of constructors, method and constructor overloading, nesting of methods, command line arguments, garbage collection, visibility control: public, private, protected, default, private protected	Chalk-Board Demonstration Flipped Classroom Presentations
2	TLO 2.1 Apply identified type of inheritance for the given programming problem. TLO 2.2 Differentiate between overloading and overriding with the help of examples. TLO 2.3 Develop program using interface. TLO 2.4 Create user defined package for the given problem.	**Unit - II Inheritance, Interface and Packages** 2.1 Inheritance: concept of inheritance , types of Inheritance: single inheritance, multilevel inheritance, hierarchical inheritance, method overriding, final variables, final methods, use of super, abstract methods and classes 2.2 Interfaces: Define interface, implementing interface, accessing interface variables and methods, extending interfaces 2.3 Package: Define package, types of package, naming and creating package, accessing package, import statement, static import, adding class and interfaces to a package	Lecture Using Chalk-Board Presentations Hands-on Flipped Classroom

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Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Distinguish the errors and exceptions with example. TLO 3.2 Develop program for handling the given exception. TLO 3.3 Create threads to run multiple processes in a program. TLO 3.4 Develop program using different thread life cycle methods.	**Unit - III Exception Handling and Multithreading** 3.1 Errors and Exception: Types of errors and exceptions, try and catch statement, throws and finally statement, built-in exceptions, throwing our own exception 3.2 Multithreaded programming : creating a thread: By extending to thread class and by implementing runnable Interface, Life cycle of thread: Thread methods, thread exceptions, thread priority and methods, synchronization	Lecture Using Chalk-Board Presentations Flipped Classroom Hands-on
4	TLO 4.1 Write steps to develop Graphical User Interface (GUI) using AWT components with frame for the given problem. TLO 4.2 Develop program using menu and dialog boxes for the given problem. TLO 4.3 Write steps to develop Graphical user interface (GUI) using advanced swing components for the given problem. TLO 4.4 Use delegation event model to develop event driven program for the given problem. TLO 4.5 Use relevant AWT/ Swing component(s) to handle the given event.	**Unit - IV Event handling using Abstract Window Toolkit (AWT) & Swings Components** 4.1 Component, container, window, frame, panel, use of AWT controls: labels, buttons, checkbox, checkbox group, textfield, textarea 4.2 Use of layout managers: flowLayout, borderLayout, gridLayout, gridBagLayout, menubars, menus, file dialog 4.3 Introduction to swing: Swing features, difference between AWT and Swing. 4.4 Swing components: Icons and Labels, TextField, ComboBox, Button, Checkbox, RadioButton 4.5 Advanced Swing Components: Tabbed Panes, Scroll Panes, Trees, Tables, Progress bar, tool tips 4.6 Introduction to Event Handling: The delegation Event Model: Event sources, Event listeners 4.7 Event classes: The action event class, the Item event class, the Key event class, the mouse event class, text event 4.8 Event listener interfaces: ActionListener , ItemListener , KeyListener , MouseListener , MouseMotion , TextListener	Lecture Using Chalk-Board Presentations Demonstration Hands-on
5	TLO 5.1 Describe the concepts of sockets in java. TLO 5.2 Use networking classes to retrieve host details. TLO 5.3 Develop program for Client/Server communication through TCP/IP Server sockets for the given problem.	**Unit - V Basics of Network Programming** 5.1 Socket Overview: Client/Server , reserved Sockets , proxy servers , Internet Addressing 5.2 Java and the Net: The networking classes and interfaces, InetAddress : Factory Methods , Instance Methods 5.3 TCP/IP Client and Server Sockets, datagram sockets, datagram packets 5.4 The URL Class, URLConnection class	Lecture Using Chalk-Board Presentations Flipped Classroom Hands-on
6	TLO 6.1 Choose relevant database connectivity methods. TLO 6.2 Describe two tier and three tier architecture of JDBC. TLO 6.3 Choose relevant type of JDBC driver for the specified environment. TLO 6.4 Elaborate steps with example to establish connectivity with the specified database.	**Unit - VI Interacting with Database** 6.1 Introduction to JDBC, ODBC 6.2 JDBC architecture: Two tier and three tier models 6.3 Types of JDBC drivers, Class Class , DriverManager class, Connection interface, Statement interface, PreparedStatement interface, ResultSet Interface	Lecture Using Chalk-Board Presentations Flipped Classroom Hands-on

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

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Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Install any IDE software application.	1	* Setup Java Programming development environment using: • Command prompt.(Classpath and path setup) • Any IDE (Eclipse, Netbeans, VScode, Jcreator etc.).	2	CO1
LLO 2.1 Implement programs to evaluate different types of Expressions.	2	Write programs to evaluate different types of expressions.	2	CO1
LLO 3.1 Develop program to implement different control structures.	3	Write programs to demonstrate use of: • if statements (all forms of if statement • Switch – Case statement • Different types of Loops(for,while and do..while).	2	CO1
LLO 4.1 Develop program to implement different control structures.	4	*Write programs for implementation of different methods of: • String class. • StringBuffer class.	2	CO1
LLO 5.1 Implement array and vectors in Java.	5	* Write programs to demonstrate: • Use of Array. • Use of Vectors .	2	CO1
LLO 6.1 Convert primitive data types into object and vice-versa.	6	Write programs using Wrapper Class : • to convert primitive into object. • to convert object into primitive.	2	CO1
LLO 7.1 Initialize objects using constructors.	7	Develop a program for implementation of different types of constructors.	2	CO1
LLO 8.1 Implement concepts of inheritance for code reusability.	8	Develop program to implement: • Single inheritance. • Multilevel inheritance.	2	CO2
LLO 9.1 Implement multiple inheritance.	9	* Develop program for implementation of interface.	2	CO2
LLO 10.1 Implement packages in Java.	10	*Write programs to demonstrate use of : • Built in packages • User defined packages.	2	CO2
LLO 11.1 Identify the different types of errors using exception handling.	11	Write programs for implementation of try, catch and finally block.	2	CO3
LLO 12.1 Manage different types of user defined exceptions.	12	*Write programs for implementation of throw, throws clause.	2	CO3
LLO 13.1 Execute different processes simultaneously using multithreading.	13	*Write programs using multithreading.	2	CO3

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Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 14.1 Design GUI using different AWT components.	14	* Write program to design any type of form using AWT components.	2	CO4
LLO 15.1 Design GUI using different menu class.	15	Write program to create a menu bar with various menu items and sub menu items.	2	CO4
LLO 16.1 Design GUI using border layout manager.	16	Write program to demonstrate the use of border layout. The layout shows four buttons at four sides with captions “left”, “right”, “top” and “bottom” using Swing Components.	2	CO4
LLO 17.1 Design GUI using grid layout manager.	17	*Write program to design a calculator to demonstrate the use of grid layout using swing components.	2	CO4
LLO 18.1 Implement swing components in a frame.	18	Write program using swing to display a JComboBox in a JFrame .	2	CO4
LLO 19.1 Design tree and table using advanced swing components in a frame.	19	Write program to create JTree and JTable.	2	CO4
LLO 20.1 Implement various keys and mouse events.	20	* Write program to handle key events and mouse events.	2	CO4
LLO 21.1 Implement action event in java.	21	*Write program to implement action event in frame using swing components.	2	CO4
LLO 22.1 Implement text event in java.	22	Write program to handle text event on swing components.	2	CO4
LLO 23.1 Extract the hostname and IP address using InetAddress class.	23	Write program to retrieve hostname and IP address using InetAddress class.	2	CO5
LLO 24.1 Retrieve various components of URL using different methods of URL and URLConnection class.	24	*Write program to demonstrate various methods of: • URL class. • URLConnection.	2	CO5
LLO 25.1 Implement client-server TCP based communication.	25	*Write program that demonstrates connection oriented communication using socket.	2	CO5
LLO 26.1 Implement client-server UDP based communication.	26	Write program to demonstrate sending and receiving data through datagram.	2	CO5
LLO 27.1 Make database connectivity using appropriate JDBC driver.	27	*Write program to: • Create sample database. • Make connectivity with database.	2	CO6
LLO 28.1 Manage database using JDBC.	28	*Write program to implement following operations on database: • Insert record. • Update record. • Delete record.	2	CO6
LLO 29.1 Manage database using JDBC.	29	Write program to demonstrate the use of PreparedStatement.	2	CO6
LLO 30.1 Implement dynamic query.	30	*Write program to retrieve data from table using ResultSet interface.(Use various methods of navigation methods).	2	CO6

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Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Other

- Complete any course of Java Programming on Infosys Springboard/Spoken Tutorial/NPTEL
- Develop java code for given problem suggested by course teacher.

Micro project

- Develop mini-ATM machine system. It should accept account_no, account_holder_name, account_balance and perform operations such as withdrawal, Deposit and balance check.
- Develop Quiz Management System. Quiz should accept student credentials and contain 10 MCQ type questions. Determine the final result. Save the result in table along with student credentials.
- Energy Billing System: Expected to develop bill amount module based on usage of energy consumption.
- Develop Employee Management System. Insert employee details such as employee_name, emp_id,emp_salary etc.. into database and retrieve data from table.
- Any other micro project as suggested by course teacher.

Assignment

- Solve assignment covering all COs given by course teacher.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Databases like MySQL, Oracle, MS-Access or any other.	27,28,29,30
2	Computer System (Any computer system with basic configuration).	All
3	Computer with JDK1.8 or above, any IDE for Java Programming such as Eclipse, Jcreator, NetBeans,VScode .	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

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Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Basic Syntactical Constructs in Java	CO1	8	4	4	4	12
2	II	Inheritance, Interface and Packages	CO2	10	2	4	6	12
3	III	Exception Handling and Multithreading	CO3	12	2	4	6	12
4	IV	Event handling using Abstract Window Toolkit (AWT) & Swings Components	CO4	14	4	4	8	16
5	V	Basics of Network Programming	CO5	8	2	4	4	10
6	VI	Interacting with Database	CO6	8	2	2	4	8
Grand Total				**60**	**16**	**22**	**32**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Continuous assessment based on process and product related performance indicators.
- Each practical will be assessed considering 60% weightage to process 40% weightage to product
- A continuous assessment based on term work

Summative Assessment (Assessment of Learning)

- End semester examination, Lab performance, Viva voce

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	2	2	1	2	--	1	1			
CO2	2	2	2	2	--	1	1			
CO3	2	2	2	2	--	1	1			
CO4	2	2	2	2	1	2	2			
CO5	2	2	3	2	1	2	2			
CO6	2	2	3	3	1	2	2			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	E Balaguruswamy	Programming with JAVA	Mcgraw Hill Education (India) Private Limited, New Delhi . ISBN-13: 978-93-5134-320-2
2	Schildt Herbert	Java Complete Reference	Mcgraw Hill Education, New Delhi . ISBN:9789339212094
3	Holzner, Steven et al	Java 8 Programming Black Book	Dreamtech Press, New Delhi. ISBN: 978-93-5119-758-4

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.javatpoint.com/java-tutorial	All content
2	https://www.w3schools.com/java/	All content
3	https://www.tutorialspoint.com/java/index.htm	All content
4	https://www.programiz.com/java-programming/online-compiler/	Online compiler for java
5	https://onecompiler.com/java	Online compiler for java
6	https://www.odbms.org/wp-content/uploads/2013/11/009.01-Arlow-JDBC-Tutorial-July-2005.pdf	Database Connectivity
7	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_29959473947367270000_shared/overview	All content
8	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013842009554911232973 0_shared/overview	All content
9	https://onlinecourses.nptel.ac.in/noc22_cs47/preview	All content

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students