

Program Name : Computer Engineering Program Group
Program Code : CO/CM/IF/CW
Semester : Fifth
Course Title : Advanced Java Programming
Course Code : 22517

1. RATIONALE

Java technology is widely used for web applications development. Based on the object oriented concepts and core Java concepts, this course will equip the students with the required knowledge and skill of object oriented programming approach needed for the development of robust, powerful web applications. Through this course students will get hands-on experience on GUI Technologies viz. AWT and Swings, event handling mechanisms and network programming. The course also gives coverage to various web applications aspects like Database Interaction, server side components and servlets.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Develop web and stand-alone applications using advanced concepts of Java.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Develop programs using GUI Framework (AWT and Swing).
- Handle events of AWT and Swings components.
- Develop programs to handle events in Java Programming.
- Develop Java programs using networking concepts.
- Develop programs using database.
- Develop programs using Servlets.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	1	2	6	3	70	28	30*	00	100	40	25#	10	25	10	50	20

(*): Under the theory PA; Out of 30 marks, 10 marks of theory PA are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

Legends: **L**-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** -Practical; **C** – Credit, **ESE** -End Semester Examination; **PA** - Progressive Assessment.

5. COURSE MAP(with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the



course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

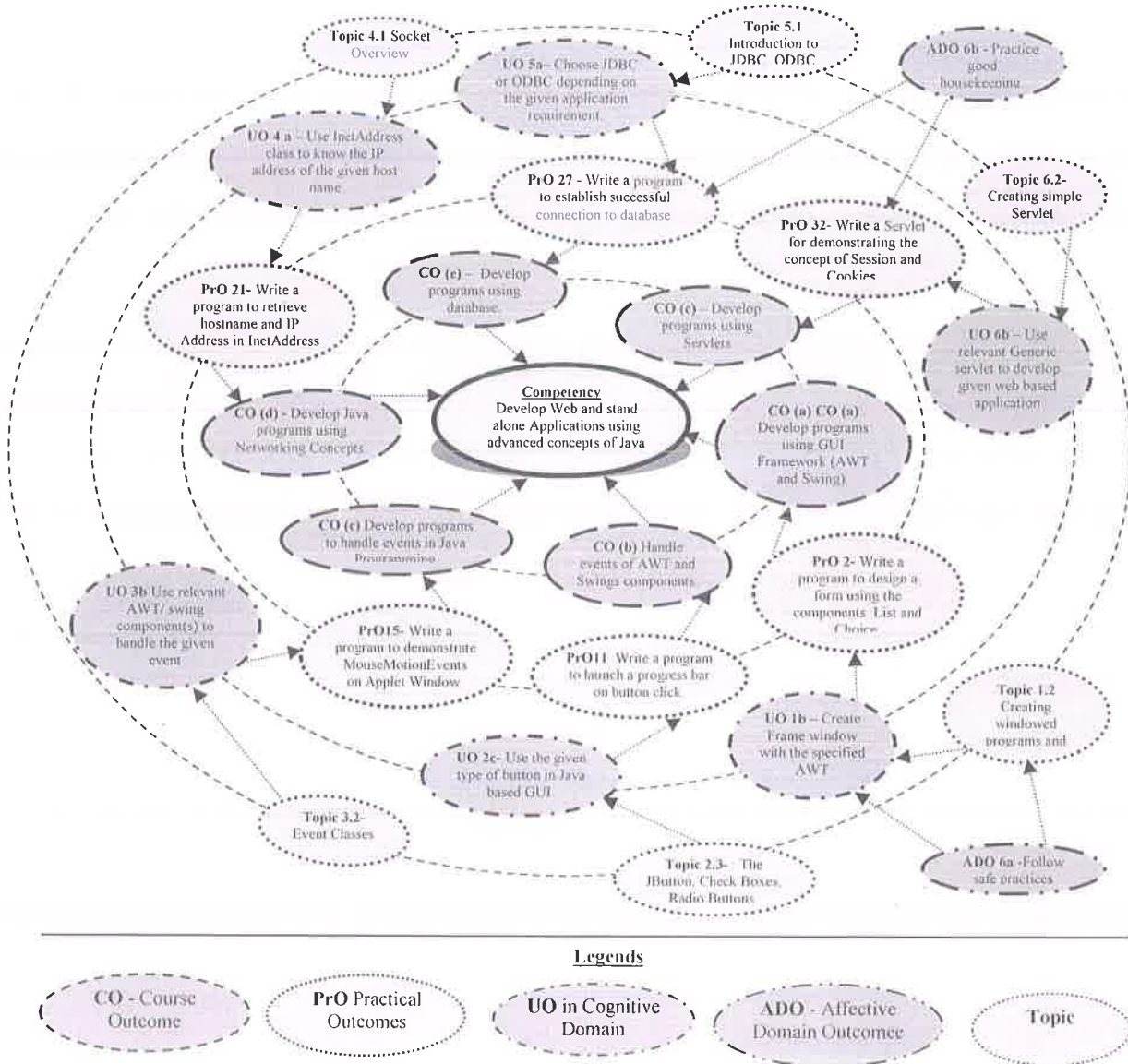


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1.	Write a program to demonstrate the use of components like Label, Textfield, TextArea, Button, Checkbox, RadioButton (CheckboxGroup).	I	02*
2.	Write a program to design a form using the components List and Choice.	I	02*
3.	Write a program to demonstrate the use of Border layout showing four buttons at four sides of an applet with captions “left”, “right”, “top” and “bottom”.	I	02*
4.	Write a program to design a simple calculator to demonstrate the use of Grid layout .	I	02*



Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
5.	Use GridBag layout to write a program to create a NUM pad on keyboard.	I	02
6.	Use of Cardlayout to write a program to create a two-level card deck that allows the user to select an operating system.	I	02
7.	Write a program using AWT to create a menubar where menubar contains menu items such as File, Edit, View and create a submenu under the File menu: New and Open.	I	02*
8.	Write a program using swing to display a ScrollPane and JComboBox in an Japplet with the items – English, Marathi, Hindi, Sanskrit.	II	02
9.	Write a program to create a Jtree and recognize mouse clicks on it in an Japplet.	II	02*
10.	Write a program to create a JTable on JApplet Window.	II	02*
11.	Write a program to launch a progress bar on button click.	II	02*
12.	Write a program to accept keyboard input to show the pressed/released status of each key on Applet Window.	III	02*
13.	Write a program to demonstrate use of some special keys (for example: F1, pgdown etc.) on Applet Window using KeyEvent class.	III	02*
14.	Write a program to demonstrate MouseEvents on Applet Window.	III	02*
15.	Write a program to demonstrate MouseMotionEvents on Applet Window.	III	02
16.	Write a program to perform basic arithmetic operations on two numbers using TextField and Button to handle ActionEvent in an applet.	III	02*
17.	Write a program to select checkbox item by using ItemEvent class in an applet.	III	02*
18.	Write a program that creates the user name and password screen using TextEvent class in an applet.	III	02*
19.	Write a program to handle window operations like minimize, maximize, close etc. to handle Window Events.	III	02*
20.	Write a program to demonstrate the use of Adapter class.	III	02
21.	Write a program to retrieve hostname and IP Address in InetAddress class.	IV	02*
22.	Write a program to use URLConnection class and display (I) Protocol (II) HostName (III) PortNumber (IV) File Name.	IV	02*
23.	Write a program (Procedure for Server Program) that demonstrates TCP/IP based communication between Client and Server. Client send a message to Server and Server replies back the acknowledgement of received message to Client	IV	02*
24.	Write a program (Procedure for Client Program) that demonstrates TCP/IP based communication between Client and Server. Client send a message to Server and Server replies back the acknowledgement of received message to Client.	IV	02*
25.	Write a program (Procedure for Server Program) that demonstrates UDP based communication between Client and Server. Client send a message to Server and Server replies back the acknowledgement of received message to Client.	IV	02
26.	Write a program (Procedure for Client Program) that demonstrates UDP based communication between Client and Server. Client send a	IV	02



Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	message to Server and Server replies back the acknowledgement of received message to Client.		
27.	Write a program to establish successful connection to database.	V	02*
28.	Write a program to send data to Table (for ex. "Student" table)in database using prepared statement and retrieve data from same Table "Student" and display on screen.(Part-I)	V	02*
29.	Write a program to send data to Table (for ex. "Student" table) in database using prepared statement and retrieve data from same Table "Student" and display on screen.(Part-II)	V	02*
30.	Write a Servlet (Procedure for Client side) to display the user name and password accepted from the client.	VI	02*
31.	Write a Servlet (Procedure for Server side) to display the user name and password accepted from the client.	VI	02*
32.	Write a Servlet for demonstrating the concept of Session and Cookies.	VI	02
Total			64

Note

- i. A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 24 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Application Level' of Bloom's Taxonomy' as generally required by the industry.
- ii. It is advisable to conduct 50% of the practicals using ASCII text editor and compilation on command prompt so as to enhance fundamental understanding of basic concepts and syntax. The IDEs must be Introduced at later stage.
- iii. The 'Process' and 'Product' related skills associated with each PrO are to be assessed according to a suggested sample given below:

Sr. No.	Performance Indicators	Weightage in %
1	Logic Building and Coding	50
2	Testing and Debugging of the Program.	30
3	Correctness of Program Output.	10
4	Submission of practical assignment in time.	10
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- a. Follow safety practices.
- b. Practice good housekeeping.
- c. Work as a leader/a team member.
- d. Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year



- ‘Organising Level’ in 2nd year and
- ‘Characterising Level’ in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO No.
1	Computer with JDK1.5 or above , any IDE for Java Programming such as Eclipse, Jcreator, NetBeans.	All
2	Databases like MySQL, Oracle, MS-Access or any other	27,28, 29
3	Apache Tomcat web server version 7 or higher.	30,31, 32

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Abstract Windowing Toolkit (AWT)	1a. Develop Graphical user interface (GUI) programs using AWT components for the given problem. 1b. Create Frame window with the specified AWT components. 1c. Arrange the GUI components using specified layout manager. 1d. Develop a program using menu and Dialog Boxes for the given problem.	1.1 Component, container, window, frame, panel. 1.2 Creating windowed programs and applets. 1.3 AWT controls and layout managers: use of AWT controls: labels, buttons, checkbox, checkbox group, scroll bars, text field, text area. 1.4 Use of layout managers: flowLayout, BorderLayout, GridLayout, CardLayout, GridBagLayout, menubars, menus, dialog boxes, file dialog.
Unit-II Swings	2a. Differentiate between AWT and Swing on the given aspect. 2b. Develop Graphical user interface (GUI) programs using swing components for the given problem. 2c. Use the given type of button in Java based GUI. 2d. Develop Graphical user interface (GUI) programs using advanced swing components for the given problem.	2.1 Introduction to swing: Swing features, Difference between AWT and Swing. 2.2 Swing Components: JApplet, Icons and Labels, Text Fields, Combo Boxes. 2.3 Buttons: The JButton, Check Boxes, Radio Buttons. 2.4 Advanced Swing Components: Tabbed Panes, Scroll Panes, Trees, Tables, Progress bar, tool tips. 2.5 MVC Architecture.



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit– III Event Handling	3a. Use delegation event model to develop event driven program for the given problem. 3b. Use relevant AWT/ swing component(s) to handle the given event. 3c. Use Adapter classes in Java program to solve the given problem. 3d. Use inner classes in java program to solve the given problem.	3.1 The delegation Event Model: Event sources, Event listeners 3.2 Event classes: The Action Event class, the Item Event class, the Key Event class, the Mouse Event class, the Text Event class, the Window Event class. 3.3 Adapter classes. 3.4 Inner classes. 3.5 Event listener interfaces: ActionListener Interface, ItemListener Interface, KeyListener Interface, MouseListener Interface, MouseMotion Interface, TextListener Interface, WindowsListener Interface.
Unit– IV Networking Basics	4a. Use InetAddress class to know the IP address of the given host name. 4b. Use URLConnection classes to read and write data to the specified resource referred by the given URL. 4c. Develop program for Client/ Server communication through TCP/IP Server sockets for the given problem. 4d. Write program to illustrate the Client/Server communication using datagram protocol for the given problem.	4.1 Socket Overview: Client/Server , Reserved Sockets , Proxy Servers , Internet Addressing. 4.2 Java and the Net: The Networking Classes and interfaces. 4.3 InetAddress : Factory Methods , Instance Methods. 4.4 TCP/IP Client Sockets : Whois 4.5 URL: Format, The URI Class. 4.6 URLConnection : TCP/IP Server Sockets . 4.7 Datagrams : Datagram Packet , Datagram Server and Client .
Unit –V Interacting with Database	5a. Choose JDBC or ODBC depending on the given application requirement. 5b. Explain function of the given tier of JDBC architecture for two tier/three tier models. 5c. Use relevant type of JDBC Driver for the specified environment. 5d. Elaborate steps with example to establish connectivity with the specified database.	5.1 Introduction to JDBC, ODBC 5.2 JDBC Architecture: Two tier and three tier models 5.3 Types of JDBC Drivers 5.4 Driver Interfaces and Driver Manager class: Connection InterfacenStatement Interface, Prepared Statement Interface, ResultSet Interface 5.5 The essential JDBC Program
Unit –VI Servlets	6a. Explain function of the given method of Servlet life cycle. 6b. Use relevant Generic servlet to develop given web based application.	6.1 The Life Cycle of a Servlet 6.2 Creating simple Servlet:The Servlet API, javax.servlet Package, Servlet Interface, ServletConfig Interface , ServletContext Interface



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	6c. Use relevant HTTP servlet to develop specified web based application. 6d. Develop servlet for cookies and session tracking to implement the given problem.	ServletRequest Interface, ServletResponse Interface, GenericServlet Class 6.3 The javax.servlet.http Package:HttpServletRequest Interface , HttpServletResponse Interface, HttpSession Interface , Cookie Class, HttpServlet Class, HttpSessionEvent Class , HttpSessionBindingEvent Class. 6.4 Handling HTTP Requests and Responses Handling HTTP GET Requests Handling HTTP POST Requests. 6.5 Cookies and Session Tracking. 6.6 Introduction to JSP

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Abstract Windowing Toolkit(AWT)	10	02	04	06	12
II	Swings	08	02	02	04	08
III	Event Handling	12	02	04	08	14
IV	Networking	10	02	04	06	12
V	Interacting with Database	12	02	04	06	12
VI	Servlets	12	02	04	06	12
Total		64	12	22	36	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of LOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Prepare journals based on practical performed in laboratory.
- Follow coding standards.
- Develop variety of programs to improve the logical skills.
- Develop Application oriented real world programs.



- e) Prepare power point presentation depicting different advanced concepts in Java.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- a) Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- b) '**L**' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c) About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- d) With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- e) Use different Audio Visual media for Concept understanding.
- f) Guide student(s) in undertaking micro-projects.
- g) Demonstrate students thoroughly before they start doing the practice.
- h) Observe continuously and monitor the performance of students in Lab.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

- a) Energy Billing System: Expected to develop bill amount module based on usage of energy consumption.
- b) Medical Store stock Management System: Expected to develop an Inventory module.
- c) Library book issue Management System.
- d) Restaurant Management System: Expected to develop a module to place an order and generate bill.
- e) Online Bus Reservation System: Expected to develop Ticket booking module.

Follow the below given guidelines for micro projects:

- i. Must implement concepts of AWT or SWING and Event Handling.
- ii. Use JDBC concepts.
- iii. Use Servlet.



13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1.	Complete Reference Java	Schildt, Herbert	Mcgraw Hill Education, New Delhi ISBN:9789339212094
2.	Java 2 Programming Black Book	Holzner, Steven et al.	Dreamtech Press, New Delhi ISBN 10: 817722655X / ISBN 13: 9788177226553
3.	Java Server Programming Tutorial JAVA EE6 Black Book	Kogent Learning Solutions	Dreamtech Press, New Delhi ISBN :978-81-7722-937-0
4.	Advance JAVA	Dr. Rajendra Kawale	Devraj Publications,Mumbai ISBN 978-81-933551-8-3

14. SOFTWARE/LEARNING WEBSITES

- a) <https://www.tutorialspoint.com/java>
- b) <http://nptel.ac.in/courses/106105084/30>
- c) <https://www.javatpoint.com/servlet-tutorial>
- d) <https://www.tutorialspoint.com/servlets>
- e) <https://www.javatpoint.com/free-java-projects>
- f) <http://1000projects.org/java-projects.html>



