

## **CORE COURSE -3: PROGRAMMING IN JAVA**

**[CREDIT: 4, LECTURE HOURS: 60]**

### **COURSE OBJECTIVE: -**

- To learn the syntax and semantics to write Java programs.
- To understand the fundamentals of object-oriented programming in Java.
- To familiarize with the concept of inheritance, polymorphism, packages and interfaces.

### **UNIT 1: INTRODUCTION TO JAVA (4 LECTURES)**

Java Architecture and Features, Understanding the semantic and syntax differences between C++ and Java, Compiling and Executing a Java Program, Variables, Constants, Keywords, Data Types, Operators (Arithmetic, Logical and Bitwise) and Expressions, Comments, Doing Basic Program Output, Decision Making Constructs (conditional statements and loops) and Nesting, Java Methods (Defining, Scope, Passing and Returning Arguments, Type Conversion and Type Checking, Built-in Java Class Methods).

### **UNIT 2: ARRAYS, STRINGS AND I/O (8 LECTURES)**

Creating & Using Arrays (One Dimension and Multi-dimensional), Referencing Arrays Dynamically, Java Strings: The Java String class, Creating & Using String Objects, Manipulating Strings, String Immutability & Equality, Passing Strings To & From Methods, String Buffer Classes. Simple I/O using system.out and the Scanner class, Byte and Character streams, Reading/Writing from console and files.

### **UNIT 3: OBJECT-ORIENTED PROGRAMMING OVERVIEW (4 LECTURES)**

Principles of Object-Oriented Programming, Defining & Using Classes, Controlling Access to Class Members, Class Constructors, Method Overloading, Class Variables & Methods, Objects as parameters, final classes, Object class, Garbage Collection.

### **UNIT 4: INHERITANCE, INTERFACES, PACKAGES, ENUMERATIONS, AUTOBOXING & METADATA (14 LECTURES)**

Inheritance: (Single Level and Multilevel, Method Overriding, Dynamic Method Dispatch, Abstract Classes), Interfaces and Packages, extending interfaces and packages, Package and Class Visibility, Using Standard Java Packages (util, lang, io, net), Wrapper Classes, Autoboxing/Unboxing, Enumerations and Metadata.

### **UNIT 5: EXCEPTION HANDLING, THREADING, NETWORKING AND DATABASE CONNECTIVITY (15 LECTURES)**

Exception types, uncaught exceptions, throw, built-in exceptions, creating your own exceptions; Multi-threading: The Thread class and Runnable interface, creating single and multiple threads, Thread prioritization, synchronization and communication, suspending/resuming threads. Using java.net package, Overview of TCP/IP and Datagram programming. Accessing and manipulating databases using JDBC.

### **UNIT 6: APPLETS AND EVENT HANDLING (15 LECTURES)**

Java Applets: Introduction to Applets, Writing Java Applets, Working with Graphics, Incorporating Images & Sounds. Event Handling Mechanisms, Listener Interfaces, Adapter and Inner Classes. The design and

Implementation of GUIs using the AWT controls, Swing components of Java Foundation Classes such as labels, buttons, text-fields, layout managers, menus, events and listeners; Graphic objects for drawing figures such as lines, rectangles, ovals, using different fonts. Overview of servlets.

#### **REFERENCE BOOKS: -**

- 1.Ken Arnold, James Gosling, David Homes, "The Java Programming Language", 4th Edition, 2005.
- 2.James Gosling, Bill Joy, Guy L Steele Jr, Gilad Bracha, Alex Buckley, "The Java Language Specification, Java SE 8 Edition (Java Series)", Published by Addison Wesley, 2014.
- 3.Joshua Bloch, "Effective Java" 2nd Edition, Publisher: Addison-Wesley, 2008.
- 4.Cay S. Horstmann, Gary Cornell, "Core Java 2 Volume 1,9th Edition", Prentice Hall, 2012.
- 5.Cay S. Horstmann, Gary Cornell, "Core Java 2 Volume 2 - Advanced Features", 9<sup>th</sup> Edition, Prentice Hall, 2013.
- 6.Bruce Eckel, "Thinking in Java", 3rd Edition, PHI, 2002.
- 7.E. Balaguruswamy, "Programming with Java", 4th Edition, McGraw Hill, 2009.
- 8.Paul Deitel, Harvey Deitel, "Java: How to Program", 10th Edition, Prentice Hall, 2011.
- 9.Bert Bates. Kathy Sierra, "Head First Java", Orielly Media Inc. 2nd Edition, 2005.
- 10.Object Oriented Programming through JAVA, P Radha Krishna, University Press.
- 11.David J. Eck, "Introduction to Programming Using Java", Published by CreateSpace Independent Publishing Platform, 2009.
12. John R. Hubbard, "Programming with JAVA", Schaum's Series, 2nd Edition, 2004.
13. R. Nageswara, Core Java: An Integrated Approach, Dreamtech Press.

#### **CORE COURSE -3: (PROGRAMMING IN JAVA) LAB :-**

##### **[CREDIT: 2, LAB HOURS: 30]**

Students are advised to do laboratory/practical practice not limited to, but including the following types of problem :-

- 1.To find the sum of any number of integers entered as command line arguments.
- 2.To find the factorial of a given number.
- 3.To learn use of single dimensional array by defining the array dynamically.
- 4.To learn use of length in case of a two-dimensional array.
- 5.To convert a decimal to binary number.
- 6.To check if a number is prime or not, by taking the number as input from the keyboard.
- 7.To find the sum of any number of integers interactively i.e., entering every number from the keyboard, whereas the total number of integers is given as a command line argument.
- 8.Write a program that shows working of different functions of String and StringBuffer classes like set CharAt(), set Length(), append(), insert(), concat() and equals().
- 9.Write a program to create a distance class with methods where distance is computed in

terms of feet and inches, how to create objects of a class and to see the use of this pointer.

10. Modify the distance class by creating constructor for assigning values (feet and inches) to the distance object. Create another object and assign second object as reference variable to another object reference variable. Further create a third object which is a clone of the first object.

11. Write a program to show that during function overloading, if no matching argument is found, then java will apply automatic type conversions (from lower to higher data type).

12. Write a program to show the difference between public and private access specifiers. The program should also show that primitive data types are passed by value and objects are passed by reference and to learn use of final keyword.

13. Write a program to show the use of static functions and to pass variable length arguments in a function.

14. Write a program to demonstrate the concept of boxing and unboxing.

15. Create a multi-file program where in one file a string message is taken as input from the user and the function to display the message on the screen is given in another file (make use of Scanner package in this program).

16. Write a program to create a multi-level package and also creates a reusable class to generate Fibonacci series, where the function to generate Fibonacci series is given in a different file belonging to the same package.

17. Write a program that creates illustrates different levels of protection in classes/subclasses belonging to same package or different packages.

18. Write a program – Divide by Zero that takes two numbers 'a' and 'b' as input, computes a/b, and invokes arithmetic exception to generate a message when the denominator is zero.

19. Write a program to show the use of nested try statements that emphasizes the sequence of checking for catch handler statements.

20. Write a program to create your own exception types to handle situations specific to your application (Hint: Define a subclass of exception which itself is a subclass of Throwable).

21. Write a program to demonstrate priorities among multiple threads.

22. Write a program to demonstrate multi-thread communication by implementing synchronization among threads (Hint: you can implement a simple producer and consumer problem).

23. Write a program to create URL object, create a URL connection using the open connection method and then use it to examine the different components of the URL and content.

24. Write a program to implement a simple datagram client and server in which a message that is typed into the server window is sent to the client side where it is displayed.

25. Write a program that creates a Banner and then creates a thread to scroll the message in the banner from left to right across the applets window.

26. Write a program to get the URL location of code (i.e., java code) and document (i.e., html file).

27. Write a program to demonstrate different mouse handling events like :- mouse clicked(), mouse entered(), mouse exited(), mouse pressed(), mouse released() and mouse dragged().

28. Write a program to demonstrate different keyboard handling events.

29. Write a program to generate a window without an applet window using main() function.

30. Write a program to demonstrate the use of push buttons.

**COURSE OUTCOME: -**

- Skill to write java application programs using OOP principles and proper program structuring.
- Ability to create packages and interfaces.
- Ability to implement error handling techniques using exception handling.

**CORE COURSE -4: COMPUTER SYSTEM ARCHITECTURE**  
**[CREDITS: 6 (5+1), LECTURE HOURS: 60]**

**COURSE OBJECTIVE: -**

- To enable the students to understand the functionality and implementation of computer system.
- To familiarize with the various instruction codes and formats of different CPUs.
- To introduce the students to I/O and memory organization of computer system.
- To deliver an overview of Control Unit of a computer system.
- To learn the usage of parallel and vector processing.

**UNIT 1: BASIC COMPUTER ORGANIZATION AND DESIGN (13 LECTURES)**

Computer registers, bus system, instruction set, timing and control, instruction cycle, memory reference, input-output and interrupt, Interconnection Structures, Bus Interconnection design of basic computer.

**UNIT 2: CENTRAL PROCESSING UNIT (15 LECTURES)**

Register organization, arithmetic and logical micro-operations, stack organization, micro programmed control, Instruction formats, pipelining and parallel processing.

**UNIT 3: MEMORY ORGANIZATION (8 LECTURES)**

Shift registers, Multiplexers, Encoder, Decoder, Half Adder, Full Adder, Cache memory, Associative memory, mapping.

**UNIT 4: PROCESSORS (14 LECTURES)**

8086, 8088, 80286, 80386, 80486, P5, Dual Core, Core2Duo, Quadra core, Octa core, Real Mode & Protected Mode, addressing modes, instruction codes, Difference between DX & SX of different micro-processors.

**UNIT 5: BUS ARCHITECTURE (10 LECTURES)**

Bus width, Clock Pulse Generator, DMA controller, PIC (Programmed Interrupt Controller), memory, ports, Communications, Architecture - ISA, EISA (Brief Description).

**REFERENCE BOOKS: -**

- 1.M. Mano, Computer System Architecture, Pearson Education 1992.
- 2.A. J. Dos Reis, Assembly Language and Computer Architecture using C++ and JAVA,

Course Technology, 2004.

3.W.Stallings, Computer Organization and Architecture Designing for Performance, 8th Edition, Prentice Hall of India, 2009.

4.M.M. Mano, Digital Design, Pearson Education Asia, 2013.

5.Carl Hamacher, Computer Organization, Fifth edition, McGrawHill, 2012.

**COURSE OUTCOME: -**

- Ability to understand the functionality, organization and implementation of computer system.
- Skill to recognize the instruction codes and formats.
- Knowledge of the internal working of main memory, cache memory, associative memory and various modes of data transfer.
- Familiarization with the working of parallel processing and vector processing.

**AECC -2: ENVIRONMENTAL SCIENCE**  
**[LECTURE HOURS: 50]**

**UNIT 1: INTRODUCTION TO ENVIRONMENTAL STUDIES (2 LECTURES)**

- Multidisciplinary nature of environmental studies.
- Scope and importance; Concept of sustainability and sustainable development.

**UNIT 2: ECOSYSTEMS (6 LECTURES)**

i. What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession. Case studies of the following ecosystems

a) Forest ecosystem

b) Grassland ecosystem

c) Desert ecosystem

d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

ii. Land resources and land use change; Land degradation, soil erosion and soil pollution.

iii. Water: Use and over--exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state).

iv. Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

**UNIT 3: BIODIVERSITY AND CONSERVATION (8 LECTURES)**

i. Levels of biological diversity: genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots.

ii. India as a mega-biodiversity nation; Endangered and endemic species of India.

ii. Threats to biodiversity: Habitat loss, poaching of wildlife, man--wildlife conflicts, biological invasions; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

- iv. Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

#### **UNIT 4: ENVIRONMENTAL POLLUTION (8 LECTURES)**

- i. Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution.
- ii. Nuclear hazards and human health risks.
- iii. Solid waste management: Control measures of urban and industrial waste.
- iv. Pollution case studies.

#### **UNIT 5: ENVIRONMENTAL POLICIES & PRACTICES (7 LECTURES)**

- i. Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture.
- ii. Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act. International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD). Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.

#### **UNIT 6: HUMAN COMMUNITIES AND THE ENVIRONMENT (6 LECTURES)**

- i. Human population growth: Impacts on environment, human health and welfare.
- ii. Resettlement and rehabilitation of project affected persons; case studies.
- iii. Disaster management: floods, earthquake, cyclones and landslides.
- iv. Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan.
- v. Environmental ethics: Role of Indian and other religions and cultures in environmental conservation.
- vi. Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).

#### **UNIT 7: FIELD WORK (EQUIVALENT TO 5 LECTURES)**

- i. Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc.
- ii. Visit to a local polluted site - Urban/Rural/Industrial/Agricultural.
- iii. Study of common plants, insects, birds and basic principles of identification.
- iv. Study of simple ecosystems--pond, river, Delhi Ridge, etc.

#### **SUGGESTED READINGS: -**

1. Carson R., 2002. Silent Spring. Houghton Mifflin Harcourt.
2. Gadgil M. & Guha R., 1993. This Fissured Land: An Ecological History of India. University of California Press.
3. Gleeson, B. and Low N. (eds) 1999. Global Ethics and Environment, London, Routledge.

4. Gleick, P.H. 1993. Water in Crisis: Pacific Institute for study in Development Environment & Security. Stockholm Env. Institute, Oxford University Press.
5. Groom, Martha J., Gary K. Meffe and Carl Ronald Carroll. Principles of Conservation Biology. Sunderland: Sinauer Associates, 2006.
6. Grumbine, R. Edward and pandit M.K., 2013. Threats from India's Himalaya dams. Science,339: 36-37.
7. McCully P., 1996. Rivers no more: The Environmental effects of dams (pp. 29-64). Zed Books.
8. McNeill, John R., 2000. Something New Under the Sun: An Environmental History of the Twentieth Century.
9. Odum, E.P., Odum, H.T. & Andrews, J., 1971. Fundamentals of Ecology. Philadelphia: Saunders.
10. Pepper, I.L., Gerba C.P. & Brusseau, M.L., 2011. Environmental and Pollution Science. Academic Press.
11. Rao, M.N. & Datta A.K., 1987. Waste Water Treatment. Oxford and IBH Publishing Co. Pvt. Ltd.
12. Raven P.H., Hassenzahl D.M. & Berg L.R., 2012. Environment 8<sup>th</sup> Edition. John Wiley & Sons.
13. Rosencranz A., Divan S., & Noble M.L., 2001. Environmental law and policy in India. Tripathi 1992.
14. Sengupta R., 2003. Ecology and Economics: An approach to Sustainable Development. OUP.
15. Singh J.S., Singh S.P. and Gupta S.R., 2014. Ecology, Environmental Science and Conservation. S. Chand publishing, New Delhi.
16. Sodhi N.S., Gibson L. & Raven P.H. (eds) 2013. Conservation Biology: Voices from the Tropics. John Wiley & Sons.
17. Thapar V., 1998. Land of the Tiger: A Natural History of the Indian Subcontinent.
18. Warren C.E., 1971. Biology and Water Pollution Control. WB Saunders.
19. Wilson E.O., 2006. The Creation: An appeal to save life on earth. New York: Norton.
20. World Commission on Environment and Development. 1987. Our Common Future. Oxford University Press.

## **GEC -2: MATHEMATICS II**

**[CREDIT: 6, LECTURE HOURS: 60]**

### **UNIT 1: INTEGRAL CALCULUS (12 LECTURES)**

Integration of rational and irrational functions, Integration as a summation. Reduction formulae. Rectification and Quadro true with simple examples. Volume and Surface-Area of solids of revolution. Moment of Inertia.

### **UNIT 2: DIFFERENTIAL EQUATIONS - I (12 LECTURES)**

Differential Equations of the first order and first degree: Variable separable, reducible into variable separable, Homogeneous equations, Linear Differential Equations, reducible into linear differential equations.

**UNIT 3: DIFFERENTIAL EQUATIONS - II (12 LECTURES)**

Differential Equations of the first order but not of first degree and Clairaut's form, Orthogonal trajectories, Differential Equations of higher order with constant coefficients with physical examples.

**UNIT 4: CRYPTOGRAPHY (12 LECTURES)**

Data encryption techniques: Algorithm, Block and stream ciphers, Private key encryptions- DES, AES, RC4, Algorithm for public key encryptions-RSA, Message authentication and hash function.

**UNIT 5: LINEAR PROGRAMMING (12 LECTURES)**

Line segment, Hyperplane, Convex set, convex combination. Elementary properties of convex sets, Linear programming problems (LPP) - its formulation and solutions by Graphical and Simplex method.