REVISED COURSE CURRICULUM FOR 5TH SEMESTER

(Diploma in IC Manufacturing)

W.E.F. 2025-26

BOARD OF TECHNICAL EDUCATION

MUNI MAYA RAM MARG

PITAMPURA, DELHI-110034

STUDY SCHEME / CREDIT (SEMESTER – V)

IC Manufacturing

Sl	Category of Course	Code No.	Course Title	Hours per week			Total contact hrs./ week	Credits	Internal Marks	External Marks
									Time	Time
				L	T	P			1:30 Hrs. (Each Sessional)	3:00 Hrs.
1	Program Core Course	23EC-PC-301	EDC-III	3	0	0	3	**3**	50	100
2		23IM-PC-303	Semiconductor Packaging and Testing	3	0	0	3	**3**	50	100
3	Program Elective Course (Prog Elec-I)	23DE-PE-305	1.Embedded Systems	3	0	0	3	**3**	50	100
4		23EC-PE-307	2. Electronic System Assembly							
5	Open Elective Course (Open Elec-I)	23EC-OE-309**	1.Free & Open Source Software (FOSS)	3	0	0	3	**3**	50	100
6		23EC-OE-311***	2. Object Oriented Programming in Java							
7	MANDATORY COURSE	23AU-350	Indian Constitution	1	0	0	1	**1**	50	--
8	Program Core Course LAB	23EC-PC-351	EDC-III LAB	0	0	2	2	**1**	50	100
9	Program Core Course LAB	23IM-PC-353	Semiconductor Packaging and Testing LAB	0	0	2	2	**1**	50	100
10	Program Elective course LAB (Prog Elec-I)	23DE-PE-355	Embedded Systems LAB	0	0	4	4	**2**	50	100
11		23EC-PE-357	Electronic System Assembly LAB							
12	Open Elective Course (Open Elec-I)	23EC-OE-359**	1.Free & Open Source Software (FOSS) LAB	0	0	4	4	**2**	50	100
13		23EC-OE-361***	2. Object Oriented Programming in Java LAB							
14	Summer Internship	23IM-SI-363	Summer Internship*- II	0	3	0	3	**3**	50	100
								Total Credits	**22**	**500**	**900**
								Grand Total		**1400**	

*** Student have to undergo compulsory 4-6 week of internship during summer vacation after 4th Semester Exam and its credit will be evaluated in the 5th semester.**

**** This subject is same as Computer Engineering subject code 23CO-OE-309, 23CO-OE-359**

***** This subject is same as Computer Engineering subject code 23CO-OE-311, 23CO-OE-361**

Four Week Summer Internship Training after Fourth Semester will be evaluated on the basis of Daily Diary/Training Report/PPT Presentation

Course Code	:	**23EC-PC-301**
Course Title	:	Electronic Devices and Circuits - III
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Course Category	:	PC

Course Objective:

Analog electronic-III course will enable the students to understand the basics of construction, working and applications of various types of electronic components such as Thyristors and UJT, multivibrator, time-base circuits; regulated power supply. Practical exercises of this course would enable students to maintain such circuits and in turn maintain equipment having such circuits.

Course Content:

Unit – 1: Wave-shaping Circuits [6 Hrs.]
General idea about different wave shapes; Transient phenomena in R-C and R-L circuits; R-C and R-L differentiating and integrating circuits; Clipping circuits; Diode clippers- series and shunt biased type; Double clipper circuits; Zener diode clipper circuits; Use of transistors for clipping and clamping circuits; Diode clamping circuit for clamping to negative peak, positive peak or any other level for different input waveforms.

Unit– 2: Thyristors and UJT [7 Hrs.]
Characteristics, working principle and application of SCR, TRIAC, DIAC, SCS, SBS and LASCR; Basic structure, principle of operation and VI characteristics of UJT; Working of UJT as relaxation oscillator and its use in triggering of SCR.

Unit– 3: Integrated Electronics [6 Hrs.]
Introduction, advantages, and disadvantages of ICs; Classification of ICs based on Size and fabrication methods; Fabrication of transistor by planar process, a typical fabrication process for monolithic integrated circuit.

Unit 4: Timer IC [6 Hrs.]
Purpose of Timer IC, Block diagram of 555 Timer IC and its working, 555 Timer as monostable, astable and bistable multivibrators; FSK generator and Pulse position Modulator; OpAmp based monostable and astable multivibrators; Schmitt Trigger circuit.

Unit 5: Time Base Circuits [6 Hrs.]
Need of timebase or sweep waveforms; special features of time base signals; Voltage timebase circuits; Current time base circuits; Bootstrap time base generator; Miller time base generator; UJT sweep generator.

Unit 6: Regulated Power Supply [8 Hrs.]
Concept of regulation; Performance parameters of regulated power supplies;Series and Shunt regulators using transistors and OPAmp; Three terminal voltage regulator ICs 78XX family(positive, negative and variable applications; Conceptsof foldback limiting, short circuit and overload protection, current boosting in 78XX series, Basic working principle of switched mode power supply (SMPS); Floating and grounded power supplies; Multiple output power supply; Brief idea of CVT, UPS and dual track in in power supply.

Reference Books:

S. No.	Title of Book	Author	Publication
1	Basic Electronics & Linear Circuits	Bhargava, Kulshreshtha & Gupta	Tata Mcgraw-Hill
2	Electronic Principles	Malvino, A. P	Tata Mcgraw-Hill
3	Integrated Electronics	Millman & Halkias	Mcgraw-Hill

Lectures:

1. http://www.vlab.com
2. https://www.tutorialspoint.com/unijunction-transistor-construction-working-principle-and-characteristic-features
3. https://www.youtube.com/watch?v=B7wOFzCd6LA
4. https://www.instructables.com/555-Timer/

Course Outcomes:

After Completion of the course the student will be able to:

1. Explain working of SCR,UJT and their applications.
2. Explain different types of timer ICs.
3. Understand the fabrication process of integrated circuit.
4. Design circuits like Regulated power supply, UPS, CVT, Time Base circuit.

Course Code	:	**23EC-PC-351**
Course Title	:	Electronic Devices and Circuits – III LAB
Number of Credits	:	1 (L: , T: , P: 2)
Course Category	:	PC

List of Practical:

1. Plot the output waveforms of R-C differentiating circuits for square wave input for various time constants.
2. Plot the output waveforms of R-C integrating circuits for square wave input for various time constants.
3. Construct biased and unbiased series and shunt clipping circuits for positive and negative peak clipping of a sine wave using switching
4. Construct a double clipper circuit using switching diodes and sources and observe the waveshapes.
5. Construct circuit to Clamp sine and square wave to their positive and negative peaks and to a specified level.
6. Construct monostable and astable multivibrator using OpAmp and verify output.
7. Construct monostable and astable multivibrator circuits using 555 timer and verify output.
8. Plot the VI characteristics of SCR for different gate currents.
9. Construct UJT relaxation oscillator circuit and verify output.
10. Plot the VI characteristics of a TRIAC in different modes

Course Code	:	**23IM-PC-303**
Course Title	:	Semiconductor Packaging and Testing
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Course Category	:	PC

Course Objective:

1) Understand foundational knowledge of electronic systems packaging,
2) Introduce key electrical issues in packaging,
3) Explain chip-level packaging technologies
4) familiarize students with PCB structure, design tools,
5) To develop an understanding of reliability concerns,

Course Content:

Unit – 1: Overview of Electronic Systems Packaging [4 Hrs.]

Functions of Electronic Packaging, Packaging Hierarchy, IC packaging: MEMS packaging, consumer electronics packaging, medical electronics packaging, Trends and Challenges, Driving Forces on Packaging Technology, Materials for Microelectronic packaging, Packaging Material Properties, Ceramics, Polymers, and Metals in Packaging, Material for high density interconnect substrates

Unit– 2: Package Manufacturing Processes [10 Hrs.]

Electrical Issues of Systems Packaging, Signal Distribution, Power Distribution, Electromagnetic Interference, Transmission Lines, Clock Distribution, Noise Sources, Digital and RF Issues. Design Process Electrical Design: Interconnect Capacitance, Resistance and Inductance fundamentals; Packaging roadmaps - Hybrid circuits - Resistive, Capacitive and Inductive parasitics.

Unit- 3: Chip Level Packaging [6 Hrs.]

IC Assembly - Purpose, Requirements, Technologies, Wire bonding, Tape Automated Bonding, Flip Chip, Wafer Level Packaging, reliability, wafer level burn – in and test. Single chip packaging: functions, types, materials processes, properties, characteristics, trends. Multi chip packaging: types, design, comparison, trends. System – in - package (SIP); Passives: discrete, integrated, and embedded.

Unit- 4: PCB, Surface Mount Technology and Thermal Considerations [10 Hrs.]

Printed Circuit Board: Anatomy, CAD tools for PCB design, Standard fabrication, Micro via Boards. Board Assembly: Surface Mount Technology, Through Hole Technology, Process Control and Design challenges. Thermal Management, Heat transfer fundamentals, Thermal conductivity and resistance, Conduction, convection and radiation – Cooling requirements

Unit- 5: Testing [6 Hrs.]

Reliability, Basic concepts, Environmental interactions. Thermal mismatch and fatigue – failures – thermo mechanically induced –electrically induced – chemically induced. Electrical Testing: System level electrical testing, Interconnection tests, Active Circuit Testing, Design for Testability.

Reference Books:

S. No.	Title of Book	Author	Publication
1	Fundamentals of Device and Systems Packaging: Technologies and Applications	Rao R. Tummala	McGrawHill Publications
2	Microelectronics Packaging Handbook	Rao R. Tummala, Eugene J. Rymaszewski, and Alan G. Klopfenstein	Springer Nature
3	Semiconductor Advanced Packaging	John H. Lau	Springer Verlag, Singapore
4	The electronic packaging handbook	Blackwell	CRC Press

Online Resources

https://www.coursera.org/learn/manufacturing?specialization=semiconductor-packaging

https://www.coursera.org/learn/introduction-to-semiconductor-packaging?specialization=semiconductor-packaging

https://imaps.org/page/academy

Course Outcomes:

1. Discuss the various packaging types
2. Design of packages which can withstand higher temperature, vibrations and shock
3. Design of PCBs which minimize the EMI and operate at higher frequency
4. Analyze the concepts of testing methods.
5. Discuss the various packaging types

Course Code	:	**23IM-PC-353**
Course Title	:	Semiconductor Packaging and Testing Lab
Number of Credits	:	1 (L: , T: , P: 2)
Course Category	:	PC

List of Practical: (Any 8 based on the availability of kits/tools/simulator/software)

1) Study and compare thermal conductivity, dielectric constant, and mechanical properties of ceramics, polymers, and metals used in IC packaging.
2) Analyze signal reflection and crosstalk using transmission line simulation tools.
3) Create a PDN to observe voltage drops and noise in a package environment.
4) Measure resistance, capacitance, and inductance of PCB interconnects using LCR meter
5) Perform or observe wire bonding on a chip and inspect bond quality using a microscope.
6) Analyze structure, process steps, and reliability aspects of a flip-chip or WLP package.
7) Design a PCB layout using CAD tools incorporating surface-mount components.
8) Assemble a small circuit using SMT components and reflow soldering.
9) Perform thermal simulation of a packaged board and study heat dissipation via conduction/convection.
10) Perform continuity, insulation, and functionality testing using a multimeter and identify potential failure sources.

Course Code	:	**23DE-PE-305**
Course Title	:	Embedded Systems
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Course Category	:	PE

Course Objective:

1) Introduce students to the fundamental concepts of embedded systems, including hardware and software components.
2) Develop an understanding of microcontrollers, especially the 8051, and their architecture, features, and applications.
3) Enable students to write and debug programs in Embedded C for real-time microcontroller-based applications.
4) Equip students with practical knowledge of interfacing sensors, I/O devices, and communication protocols.
5) Familiarize students with the concept of real-time operating systems (RTOS) and the lifecycle of embedded product development.

Course Content:

Unit – 1: Introduction to Embedded Systems [8 Hrs.]

Block diagram of embedded systems and hardware components. Harvard vs. Von-Neumann architecture; RISC vs. CISC processors. Applications Difference between general-purpose system and embedded systems

Unit– 2: Microcontrollers and Architectures [10 Hrs.]

Microprocessor vs. Microcontroller. Overview of 8051 microcontrollers. Architecture and pin configuration of 8051. Memory organization and I/O ports. Timers, counters, and serial communication basics

Unit– 3: Programming Using Embedded C [10 Hrs.]

Introduction to Embedded C. Data types, operators, control structures. Bitwise operations and port manipulation. Functions, arrays, and pointers in embedded systems. Interrupts and their handling.

Unit- 4: Interfacing and Communication [8 Hrs.]

Interfacing input/output devices: LCD, keypad, ADC/DAC, Stepper motor and DC motor. Sensor interfacing: Temperature and IR. Communication protocols: UART, I2C, SPI. Basics of wireless modules: Bluetooth

Unit- 5: Real-Time Operating Systems (RTOS) and Applications [4 Hrs.]

Need for RTOS in embedded systems. Concepts: Task, scheduling, multitasking etc. Mini-project design steps

Reference Books:

S. No.	Title of Book	Author	Publication
1	The 8051 Microcontroller and Embedded Systems	Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay	Pearson Education
2	Embedded Systems: Architecture, Programming and Design	Raj Kamal	McGraw Hill Education
3	Embedded Systems	Shibu K.V.	McGraw Hill Education
4	Embedded System Design	Frank Vahid, Tony Givargis	Wiley India Pvt. Ltd.

Online Resources

https://users.ece.cmu.edu/~koopman/lectures/index.html

https://edurev.in/courses/10848_Embedded-Systems--Web--Notes--Videos--MCQs

https://nptel.ac.in/courses/108105102

https://freevideolectures.com/course/2341/embedded-systems

https://www.coursera.org/learn/introduction-embedded-systems

https://www.udemy.com/course/exploring-embedded-systems-part-i

Course Outcomes:

1) Explain the structure, types, and applications of embedded systems. Distinguish between Harvard and Von-Neumann architectures, and RISC vs. CISC processors.

2) Compare microprocessors with microcontrollers and describe the architecture, pin configuration, and memory of 8051. Identify features of AVR, ARM, and PIC microcontrollers.

3) Write, debug, and analyze programs in Embedded C using control structures, port manipulation, functions, arrays, and interrupts.

4) Interface I/O devices and sensors with a microcontroller and implement communication protocols (UART, I2C, SPI).

5) Explain RTOS concepts such as tasks and scheduling. Describe the embedded product lifecycle and design steps for a mini project.

Course Code	:	**23DE-PE-355**
Course Title	:	Embedded Systems LAB
Number of Credits	:	1 (L: , T: , P: 2)
Course Category	:	PE

List of Practical: (Any 8 based on the availability of software/simulators)

1. To understand the basic tools used for embedded system development such as IDEs (Keil, MPLAB, Arduino IDE), programmers, and simulators. Familiarize with embedded software tools, code compilation, and hex file generation.
2. To develop a simple embedded C program to blink an LED connected to a port pin.
3. To interface push-button switches and LEDs with 8051 and develop logic to control output based on input.
4. To use 8051's timer to generate accurate delays for LED toggling.
5. To demonstrate the use of external and timer interrupts.
6. To send text data from 8051 to an LCD module and display it.
7. To scan and detect keypresses from a matrix keypad using 8051.
8. To interface an ADC (like ADC0804) with 8051 and read analog sensor data. Convert analog input (like temperature) to digital and process it.
9. To read and display temperature on an LCD using ADC and LM35 sensor.
10. To send and receive data between PC and microcontroller via serial port.

Course Code	:	**23EC-PE-307**
Course Title	:	Electronic System Assembly
Number of Credits	:	3 (L: 3,T:0, P:0)
Course Category	:	PE

Course Objectives:

1. A core aspect is learning the processes involved in assembling electronic components onto PCBs
2. Emphasis is placed on understanding and implementing quality control procedures to ensure the reliability and performance of assembled electronics.
3. Adhering to safety standards and procedures when working with electronic components and equipment is crucial.
4. The ultimate goal is to prepare students for careers in electronics manufacturing, maintenance, or related fields.

Course Content:

UNIT - I: INTRODUCTION TO THE ELECTRONICS INDUSTRY

- Distinguish Class 1, 2, and 3 electronics products
- Types of components used in electronic assemblies
- Distinguish between component polarity and orientation
- Differentiate between wires, cables, and harnesses
- Identify types of terminals used in electronic assemblies
- Identify types of hardware used in electronic assemblies

UNIT - II: INTRODUCTION TO PRINTED CIRCUIT ASSEMBLY (PCA)

- Common features of a Printed Circuit Board (PCB)
- Common components of a Printed Circuit Assembly (PCA)
- Different attachment methods used in printed circuit assembly
- Assembly process of Surface Mount Technology (SMT)
- Assembly process of Through Hole (TH) Technology
- Identify the different post-processes within the electronics assembly process

UNIT - III: QUALITY IN ELECTRONICS MANUFACTURING

- Different quality conditions specified in IPC-A-610 and IPC-A-600
- PCB and PCA defects according to IPC standards
- Use quality condition criteria to determine component acceptability

IPC STANDARDS

- Define IPC standards in reference to the electronic manufacturing industry
- Identify the most common IPC standards relevant to assembly operators
- Compare IPC Certification programs with IPC Certificate programs
- Explain how assembly drawings are used in the assembly process
- Identify common measurement tools and symbols used in the assembly process

UNIT - IV: DESIGN OF ASSEMBLY SYSTEMS

- Design for effective manual assembly, Apply the DFMA (Design for Manufacturing and Assembly) Methodology to assess ease of manual assembly
- Learn how to design for high-speed automatic assembly
- Understand the need to ‘balance’ an assembly line for equitable task allocation.
- Parts feeding and orienting: vibratory and non-vibratory, orienting devices; escapements.
- Robot assembly.

UNIT-V: SAFETY & PRODUCT HANDLING

- Standard safety signs and symbols relevant to assembly operators.
- Standard safety procedures for protecting assembly operators, equipment, and products Potential risks and hazards of standard materials used by assembly operators.
- Safety concerns of using standard assembly equipment
- Electrostatic discharge (ESD) in electronics assembly handling procedures for PCBs and PCAs. Cause and prevention of foreign object debris (FOD)

Text Books:

1. Khandpur, Raghbir Singh. *Printed circuit boards: design, fabrication, assembly and testing*. Tata McGraw-Hill Education, 2006.
2. Marks, Leonard, and James Caterina. *Printed circuit assembly design*. McGraw-Hill Education, 2000.
3. Boothroyd, Geoffrey, Peter Dewhurst, and Winston A. Knight. *Product design for manufacture and assembly*. CRC press, 2010.

Course Outcomes:

1. Explain the assembly steps of electronic circuits and products, understand the environmental legislation and environmental threats related to electronics substrates
2. Explain the inspection methods and strategies of electronics assembly procedures
3. Overview the testing and qualification methods of electronic assemblies both from materials and joints points of view
4. Understand the concept of Industry4.0, list its elements and explain its application in electronics manufacturing

Course Code	:	**23EC-PE-357**
Course Title	:	Electronic System Assembly LAB
Number of Credits	:	2 (L: 0, T:0, P:4)
Course Category	:	PE

1. To identify and classify various electronic components used in assemblies, including resistors, capacitors, diodes, transistors, ICs, connectors, and hardware.

2. To study a Printed Circuit Board (PCB) layout and trace the signal path between components. Understand layers, pads, vias, and solder mask.

3. To assemble a simple SMT circuit on a PCB using tweezers, reflow soldering or hot air gun, and verify component orientation and placement.

4. To assemble a basic electronic circuit using through-hole components on a PCB and perform manual soldering with proper polarity and orientation.

5. To visually inspect and identify good and faulty solder joints on assembled PCBs using IPC-A-610 standards and magnification tools.

6. To evaluate assembled boards against IPC-A-600/610 standards, documenting pass/fail criteria for different classes of electronic products.

7. To understand and implement ESD safety procedures, including use of grounding straps, ESD-safe workstations, and ESD-safe tools.

8. To read and interpret electronic assembly drawings and accurately place components on a bare PCB as per given layout instructions.

9. To analyze a sample product using DFMA principles and suggest modifications to improve assembly efficiency and reduce cost.

10. To identify potential safety hazards in the assembly lab and implement FOD control techniques during and after assembly operations.

Course Code	**23EC-OE-309**
Course Title	**Free & Open Source Software (FOSS)**
Credits	3 (L:3 T:0 P:0)
Course Category	OE

Course Objective:

- To introduce students to the philosophy, history, and importance of Free and Open Source Software (FOSS).
- To provide a foundation in the use and administration of Linux-based operating systems.
- To expose students to popular open-source tools and platforms for productivity, programming, and collaboration.
- To promote awareness of licensing, copyright, and community-driven development models.

Unit 1	Introduction to Free and Open Source Software Definition: Free Software vs. Open Source Software; History and Evolution of FOSS; Philosophy of Free Software (Richard Stallman, FSF) and Open Source (OSI); Advantages and challenges of FOSS; Popular open-source projects and communities (Linux, Mozilla, LibreOffice, GitHub, etc.) Licensing and Legal Aspects Copyright and Copyleft; Free Software Licenses: GPL, LGPL, BSD, MIT, Apache; Open Standards and Software Patents; Licensing compliance and ethics in FOSS	6
Unit 2	Introduction to Linux Operating System Linux Architecture: Kernel, Shell, File System; Popular Linux Distributions: Ubuntu, Fedora, Debian; Linux Installation; The Linux Desktop Environment; Basic Linux Commands and Navigation; Users, Groups, and File Permissions; Package Management (APT, YUM); Process Management; Input/Output Redirection and Pipes; Text Editors	9
Unit 3	Open Source Tools for Productivity Office Suite: LibreOffice (Writer, Calc, Impress); Browsers and Email Clients: Mozilla Firefox, Thunderbird; Multimedia Tools: VLC Media Player, Audacity; Graphics Tools: GIMP, Inkscape	5
Unit 4	Open Source Development Tools Code Editors: VS Code, Atom; Version Control: Introduction to Git and GitHub; Scripting with Bash and Python (basic concepts); Educational and STEM tools: GCompris, GeoGebra	6
Unit 5	Basic Shell Scripting Introduction to Shell Scripting; Variables and Comments; Basic Input/Output; Conditional Statements; Loops, Case in Shell Script; Creating and Executing Simple Scripts Examples: script to create directories, backup files, display system info.	4
Unit 6	FOSS in Education, Government & Industry FOSS Adoption in Indian Government and Education (e.g., NPTEL, DIKSHA, BOSS OS); Case Studies of Successful FOSS Implementations; Careers and contribution in the FOSS ecosystem	4

Course Outcome:
After completing this course, students will be able to:

- CO1: Differentiate between proprietary and open-source software licenses and articulate the advantages and disadvantages of FOSS.
- CO2: Install and navigate a popular Linux distribution effectively.
- CO3: Execute essential Linux commands for file and directory management, process control, and system information.
- CO4: Manage users, groups, and file permissions in a Linux environment.
- CO5: Utilize common open-source applications for office productivity, web Browse, and multimedia.
- CO6: Write simple shell scripts to automate repetitive tasks.
- CO7: Identify and utilize online resources for FOSS learning and support.

Text Books

1. "Linux System Administration" by Sandeep Kamble, Sayali Parab, Chayan Bhattacharjee
2. A Practical Guide to Linux Commands, Editors, and Shell Programming by Mark G. Sobell
3. Unix: Concepts and Applications by Sumitabh Das
4. Arnold Robbins, “Linux Programming by Examples: The Fundamentals”, Pearson Education
5. "Introduction to Free Software" – FTA (Free Technology Academy)
6. "Linux Pocket Guide: Essential Commands" by Daniel J. Barrett (O'Reilly Media)
7. "Linux for Beginners: An Introduction to the Linux Operating System and Command Line" by Jason Cannon
8. "Beginning Linux Programming" by Richard Stones and Neil Matthew (Wrox)

Reference Books:

1. "Linux Command Line and Shell Scripting Bible" by Richard Blum and Christine Bresnahan
2. "UNIX and Linux System Administration Handbook" by Evi Nemeth, Garth Snyder, Trent R. Hein, Ben Whaley
3. "Producing Open Source Software" by Karl Fogel

Online Resources:

- https://onlinecourses.swayam2.ac.in/aic20_sp24/preview
- https://nptel.ac.in/courses/106105214
- https://linuxjourney.com/
- https://training.linuxfoundation.org/resources/
- Open Source Initiative (OSI): https://opensource.org/
- GNU Project: https://www.gnu.org/

Course Code	**23EC-OE-359**
Course Title	**Free & Open Source Software (FOSS) Lab**
Credits	2 (L:0 T:0 P:4)
Course Category	OE

List of Experiments (Tentative, Should not be limited to the provided list):

1. Installing a Linux OS (Ubuntu/CentOS) on VirtualBox or hardware
2. Basic shell commands and file operations
3. User, group and file permission management
4. Package installation and software updates
5. Monitoring system processes and managing services
6. Basic networking setup and troubleshooting
7. Writing and executing basic shell scripts
8. Automating tasks with cron

Course Code	**23EC-OE-311**
Course Title	**Object Oriented Programming in Java**
Credits	3 (L:3, T:0, P:0)
Course Category	OE

Course Objective:

- Understand the fundamental concepts of object-oriented programming and how they are implemented in Java.
- Learn to design and develop modular Java applications using classes, objects, inheritance, polymorphism, and abstraction.
- Apply exception handling and file I/O techniques to build robust and reliable Java programs.
- Explore and utilize Java's built-in libraries, packages, and the Collections Framework for effective data management.
- Gain introductory knowledge of GUI development and event handling using AWT and Swing components.

Unit 1	**Introduction to Java and Programming Fundamentals** History and features of Java, Java architecture: JDK, JRE, JVM, Structure of a Java program, compiling and execution process, Java tokens, identifiers, keywords, data types, Variables, constants, type casting, Operators and expressions, Control flow statements: if-else, switch, loops (for, while, do-while)	6
Unit 2	**Classes, Objects, and Constructors** Defining classes and creating objects, Fields, methods, and access modifiers (public, private, protected, default), Constructor types: default, parameterized, copy constructor, Method overloading, this keyword, Static vs. instance members, Initialization blocks (static and instance), Garbage collection and finalize (), Use of final keyword	7
Unit 3	**Arrays, Strings, and Wrapper Classes** One-dimensional and multi-dimensional arrays, Array of objects, String handling using String, String Buffer, String Builder, String immutability and memory management, Wrapper classes and autoboxing/unboxing	7
Unit 4	**Inheritance, Polymorphism, and Abstraction** Inheritance: single, multilevel, hierarchical, Use of super keyword, Method overriding and dynamic method dispatch, Compile-time and run-time polymorphism, Object type casting and instance of operator, Abstract classes and methods, Interfaces and multiple inheritance via interfaces, Introduction to lambda expressions and functional interfaces	7
Unit 5	**Exception Handling, Packages, and File I/O** Exception types: checked and unchecked, Exception handling using try-catch-finally, throw and throws keywords, Creating custom exceptions, Introduction to packages: built-in and user-defined, Import statements and access control, Basics of file handling using File, File Reader, File Writer, Serialization and deserialization basics	6

Unit 6	**Collections Framework and GUI Basics** Introduction to Java Collections Framework, Lists, Sets, Maps overview: Array List, HashSet, HashMap, Iterators and enhanced for-loop, Generics and type safety, Basics of GUI using AWT and Swing (components: JFrame, JButton, JLabel), Event handling overview, Integration of OOP concepts in application development, Best practices and coding standards in Java	6

Course Outcome:

- Explain the basic structure, syntax, and control flow of Java programs.
- Apply object-oriented programming principles like encapsulation, inheritance, and polymorphism using Java.
- Develop Java programs using abstraction, interfaces, exception handling, and file I/O.
- Analyze and use Java Collections and Generics for data structure manipulation.
- Design simple GUI applications using AWT/Swing and demonstrate event handling in Java.

Text Books

1. Schildt, H. (2018). Java: The complete reference (11th ed.). McGraw-Hill Education.
2. Sierra, K., & Bates, B. (2005). Head First Java (2nd ed.). O'Reilly Media.
3. Horstmann, C. S. (2019). Core Java Volume I – Fundamentals (11th ed.). Prentice Hall.
4. Liang, Y. D. (2021). Introduction to Java programming and data structures (12th ed.). Pearson.

Reference Books:

1. Bloch, J. (2018). Effective Java (3rd ed.). Addison-Wesley.
2. Eckel, B. (2006). Thinking in Java (4th ed.). Prentice Hall.
3. Gosling, J., Joy, B., Steele, G., Bracha, G., & Buckley, A. (2014). The Java™ Language Specification (Java SE 8 ed.). Addison-Wesley.
4. Arnold, K., Gosling, J., & Holmes, D. (2005). The Java programming language (4th ed.). Addison-Wesley.

Online Resources:

1. Oracle. (n.d.). The Java™ Tutorials. Oracle. https://docs.oracle.com/javase/tutorial/
2. Geeks for Geeks. (n.d.). Java Programming Language. https://www.geeksforgeeks.org/java/
3. W3Schools. (n.d.). Java Tutorial. https://www.w3schools.com/java/
4. JavaTpoint. (n.d.). Java Tutorial. https://www.javatpoint.com/java-tutorial
5. Oracle. (n.d.). Java SE Documentation. https://docs.oracle.com/en/java/javase/

Course Code	**23EC-OE-361**
Course Title	**Object Oriented Programming in Java LAB**
Credits	2 (L:0, T:0, P:4)
Course Category	OE

Course Objective:

- Understand the fundamental concepts of object-oriented programming and how they are implemented in Java.
- Learn to design and develop modular Java applications using classes, objects, inheritance, polymorphism, and abstraction.
- Apply exception handling and file I/O techniques to build robust and reliable Java programs.
- Explore and utilize Java's built-in libraries, packages, and the Collections Framework for effective data management.
- Gain introductory knowledge of GUI development and event handling using AWT and Swing components.

Unit I	**Java Basics and Control Structures** • Write a program to print "Hello World" and basic variable operations. • Write a program to demonstrate all data types and type casting. • Write a program to implement decision-making statements (if-else, switch). • Write a program to demonstrate different loops (for, while, do-while).	8
Unit II	**Classes, Objects, and Constructors** • Write a program to create a class with methods and instantiate objects. • Write a program using parameterized and default constructors. • Write a program to illustrate use of this keyword and static members. • Write a program to demonstrate method overloading. • Write a program to show use of access modifiers.	8
Unit III	**Arrays and Strings** • Write a program to implement single and multi-dimensional arrays. • Write a program to sort an array and search elements using linear and binary search. • Write a program to demonstrate string manipulation using String and StringBuilder. • Write a program to check whether a string is palindrome.	8
Unit IV	**Inheritance, Polymorphism, Abstraction** • Write a program to demonstrate single and multilevel inheritance. • Write a program to use the super keyword and constructor chaining. • Write a program to illustrate method overriding and dynamic method dispatch. • Write a program to create and use abstract classes. • Write a program to implement interfaces and multiple inheritance using interfaces.	8

Unit V	**Exception Handling, Packages, File I/O** • Write a program to implement try-catch-finally blocks. • Write a program to demonstrate use of throw and throws. • Write a program to create a custom exception. • Write a program to create and use user-defined packages. • Write a program to read from and write to a text file using File Reader and File Writer.	10
Unit VI	**Collections and GUI** • Write a program using Array List, HashSet, and HashMap. • Write a program to demonstrate use of Generics with a class and a method. • Write a simple GUI application using Swing (JFrame, JButton, JLabel) with event handling.	10

Course Outcome:

- Explain the basic structure, syntax, and control flow of Java programs.
- Apply object-oriented programming principles like encapsulation, inheritance, and polymorphism using Java.
- Develop Java programs using abstraction, interfaces, exception handling, and file I/O.
- Analyze and use Java Collections and Generics for data structure manipulation.
- Design simple GUI applications using AWT/Swing and demonstrate event handling in Java.

Text Books

1. Schildt, H. (2018). Java: The complete reference (11th ed.). McGraw-Hill Education.
2. Sierra, K., & Bates, B. (2005). Head First Java (2nd ed.). O'Reilly Media.
3. Horstmann, C. S. (2019). Core Java Volume I – Fundamentals (11th ed.). Prentice Hall.
4. Liang, Y. D. (2021). Introduction to Java programming and data structures (12th ed.). Pearson.

Reference Books:

1. Bloch, J. (2018). Effective Java (3rd ed.). Addison-Wesley.
2. Eckel, B. (2006). Thinking in Java (4th ed.). Prentice Hall.
3. Gosling, J., Joy, B., Steele, G., Bracha, G., & Buckley, A. (2014). The Java™ Language Specification (Java SE 8 ed.). Addison-Wesley.
4. Arnold, K., Gosling, J., & Holmes, D. (2005). The Java programming language (4th ed.). Addison-Wesley.

Online Resources:

1. Oracle. (n.d.). The Java™ Tutorials. Oracle. https://docs.oracle.com/javase/tutorial/
2. GeeksforGeeks. (n.d.). Java Programming Language. https://www.geeksforgeeks.org/java/
3. W3Schools. (n.d.). Java Tutorial. https://www.w3schools.com/java/
4. JavaTpoint. (n.d.). Java Tutorial. https://www.javatpoint.com/java-tutorial
5. Oracle. (n.d.). Java SE Documentation. https://docs.oracle.com/en/java/javase/

Course Code	**AU350**
Course Title	**Indian Constitution**
Credits	Total 1 (L: 1, T: 0; P: 0)
Course Category	Audit

Course Content:

Unit 1	The Constitution - Introduction • The History of the Making of the Indian Constitution • Preamble and the Basic Structure, and its interpretation • Fundamental Rights and Duties and their interpretation • State Policy Principles
Unit 2	Union Government • Structure of the Indian Union • President – Role and Power • Prime Minister and Council of Ministers • Lok Sabha and Rajya Sabha
Unit 3	State Government • Governor – Role and Power • Chief Minister and Council of Ministers • State Secretariat
Unit 4	Local Administration • District Administration • Municipal Corporation • Zila Panchayat
Unit 5	Election Commission • Role and Functioning • Chief Election Commissioner • State Election Commission

Text Books
1. Ethics and Politics of the Indian Constitution; Rajeev Bhargava; Oxford University Press, New Delhi, 2008 2. The Constitution of India; B.L. Fadia; Sahitya Bhawan; New edition (2017) 3. Introduction to the Constitution of India; DD Basu; Lexis Nexis; Twenty-Third 2018 edition

Online Resources:
● https://www.constitution.org/cons/india/const.html ● http://www.legislative.gov.in/constitution-of-india ● https://www.sci.gov.in/constitution ● https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-of-india/

Course Code	:	**23IM-SI-363**
Course Title	:	Summer Internship II
Number of Credits	:	3 (L:0, T:3, P: 0)
Course Category	:	Summer Internship

Rationale:

It is industrial training, which provides an opportunity to students to experience the environment and culture of industrial production units and commercial activities undertaken in field organizations. It prepares student for their future role as diploma engineers in the world of work and enables them to integrate theory with practice.

Learning Outcome:

After studying this course, students will be able to:

- Demonstrate organizational setup, product range, manufacturing process, important machines and materials used in the training organization.
- Write daily & final report and its presentation later on.
- Demonstrate working culture of industry.
- Solve problem in industrial setup and to apply the knowledge and skills learnt in real life situations.

Detailed Contents

- Industrial training of a minimum of 4 weeks duration to be organized during the semester break starting after second Semester examinations.
- It is suggested that a training schedule may be drawn for each student before starting of the training in consultation with the training providers. Students should also be briefed in advance about the organizational setup, product range, manufacturing process, important machines and materials used in the training organization.
- Students should be encouraged to write daily report in their diary to enable them to write final report and its presentation later on.

An assessment has been provided in the study and evaluation scheme of v Semester. Evaluation of summer training report through viva-voce/presentation may comprise of weightage to performance in general behavior, quality of report, presentation during viva-voce examination and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situations.