

Module 4: Mobile Circuit & Diagnostics (Classes 12–16)

Module Duration: 10 Hours (5 Classes × 2 Hours)

Module Overview

This module introduces students to smartphone motherboard architecture, electronic circuits, diagnostic techniques, and professional troubleshooting methods. Students will learn how to identify motherboard sections, read mobile schematics and board view diagrams, use a digital multimeter and DC power supply for diagnostics, detect short circuits, analyze current consumption, and troubleshoot common hardware faults such as no power, charging issues, display failures, and network problems.

Module Learning Objectives

After completing this module, students will be able to:

- Understand the structure of a smartphone motherboard (PCB).
 - Identify power, ground, charging, RF, and display circuits.
 - Read mobile schematics and board view diagrams.
 - Use a digital multimeter for hardware diagnostics.
 - Use a DC power supply for current analysis.
 - Detect short circuits and no-power faults.
 - Diagnose common smartphone hardware problems.
 - Apply systematic troubleshooting techniques.
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Class 12 (2 Hours)

Mobile Motherboard & Circuit Fundamentals

Learning Outcomes

After completing this class, students will be able to:

- Identify motherboard sections.
 - Explain PCB construction.
 - Understand power and ground circuits.
 - Locate major ICs and components.
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12.1 Mobile Motherboard (PCB)

The **Printed Circuit Board (PCB)** is the main electronic board of a smartphone. It connects all components and distributes power and signals.

Main Functions

- Power distribution
 - Data communication
 - Signal processing
 - Component interconnection
 - Hardware control
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12.2 PCB Layers

Modern smartphones use **multi-layer PCBs**.

Common PCB Layers

- Top Layer
- Bottom Layer
- Internal Signal Layers
- Power Plane
- Ground Plane

Advantages

- Compact design
 - Reduced electrical noise
 - Better signal integrity
 - Improved heat dissipation
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12.3 Major Motherboard Sections

Typical motherboard sections include:

- CPU Section
 - RAM Section
 - Storage (eMMC/UFS)
 - Power Management IC (PMIC)
 - Charging Circuit
 - RF (Network) Section
 - Audio Circuit
 - Display Circuit
 - Camera Circuit
 - SIM Card Interface
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12.4 Power Circuit

The power circuit supplies regulated voltage to all smartphone components.

Main Components

- Battery Connector
 - PMIC
 - Charging IC
 - Voltage Regulators
 - Power Filters
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12.5 Ground Circuit

Ground (GND) provides the electrical return path.

Functions

- Voltage reference
 - Circuit stability
 - Noise reduction
 - Component protection
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Practical Exercise

Students will:

- Identify motherboard sections.
 - Locate PMIC, CPU, RAM, storage, charging IC, and RF section.
 - Trace power and ground paths using a board view diagram.
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Assignment

Draw a simplified smartphone motherboard and label its major sections.

Class 13 (2 Hours)

Mobile Schematics & Board View

Learning Outcomes

Students will be able to:

- Read smartphone schematics.
 - Use board view software.
 - Identify motherboard components.
 - Locate test points.
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13.1 Mobile Schematics

A schematic is an electronic circuit diagram showing how components are connected.

Benefits

- Fault diagnosis
- Circuit tracing
- Component identification
- Voltage analysis

13.2 Schematic Symbols

Common symbols include:

- Resistor
- Capacitor
- Diode
- Inductor
- Transistor
- IC
- Ground
- Battery
- Connector
- Fuse

13.3 Board View Software

Board view software displays the physical layout of motherboard components.

Features

- Component location
- Test points
- Signal tracing
- Component numbering
- PCB layout

13.4 Component Identification

Students will learn to identify:

- Resistors
- Capacitors
- Coils
- Diodes
- MOSFETs
- ICs
- Connectors
- Test Pads

Practical Exercise

Students will:

- Open a sample schematic.
- Identify major components.
- Locate charging circuit components.
- Match schematic symbols with real motherboard parts.

Assignment

Identify and label ten common motherboard components using a board view diagram.

Class 14 (2 Hours)

Multimeter Testing

Learning Outcomes

Students will be able to:

- Operate a digital multimeter safely.
 - Measure voltage and resistance.
 - Perform continuity and diode testing.
 - Diagnose faulty motherboard components.
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14.1 Digital Multimeter

A digital multimeter is the primary diagnostic tool for mobile repair technicians.

Functions

- Voltage Measurement
- Resistance Measurement

- Continuity Testing
 - Diode Testing
 - Current Measurement (supported models)
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14.2 Continuity Test

Purpose

- Detect broken tracks
 - Verify electrical connections
 - Locate short circuits
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14.3 Voltage Test

Used to verify:

- Battery voltage
 - Charging voltage
 - Power rails
 - Output of voltage regulators
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14.4 Resistance Test

Measures the resistance of:

- Resistors
 - Coils
 - Power lines
 - Ground lines
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14.5 Diode Mode

Used for:

- Checking diode functionality
- Detecting short circuits

- Comparing signal lines
 - Diagnosing power rails
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Practical Exercise

Students will:

- Measure battery voltage.
 - Test continuity of PCB tracks.
 - Measure resistance of selected components.
 - Perform diode mode testing on motherboard circuits.
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Assignment

Record multimeter readings for different motherboard test points and explain the results.

Class 15 (2 Hours)

DC Power Supply & Power Diagnosis

Learning Outcomes

Students will be able to:

- Use a DC regulated power supply.
 - Analyze current consumption.
 - Detect short circuits.
 - Diagnose no-power faults.
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15.1 DC Power Supply

A DC power supply powers a smartphone motherboard externally for diagnostic purposes.

Functions

- Controlled voltage output
 - Adjustable current limit
 - Current monitoring
 - Short circuit protection
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15.2 Current Consumption

Current consumption helps identify motherboard faults.

Typical Conditions

- No Current: Open circuit or power path failure
 - Low Current: Boot failure or missing signal
 - High Current: Short circuit or faulty IC
 - Normal Boot Pattern: Healthy device startup
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15.3 Short Circuit Detection

A short circuit occurs when power is directly connected to ground or another unintended path.

Common Causes

- Water damage
 - Burned IC
 - Damaged capacitor
 - PCB damage
 - Incorrect repair work
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15.4 No Power Diagnosis

Troubleshooting Steps

1. Check battery voltage.
2. Test battery connector.
3. Verify charging voltage.
4. Measure current draw.
5. Inspect PMIC.
6. Check power button circuit.
7. Inspect for short circuits.

Practical Exercise

Students will:

- Connect a motherboard to a DC power supply.
- Observe startup current consumption.
- Detect short circuits.
- Diagnose a no-power motherboard.

Assignment

Explain the relationship between abnormal current consumption and motherboard faults.

Class 16 (2 Hours)

Common Mobile Hardware Faults

Learning Outcomes

Students will be able to:

- Diagnose common hardware problems.
 - Apply structured troubleshooting methods.
 - Verify successful repairs.
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16.1 No Power

Possible Causes

- Dead battery
- Faulty PMIC
- Short circuit
- Damaged power button
- Broken power line

16.2 Auto Restart

Possible Causes

- Battery failure
- Corrupted firmware
- Overheating
- Faulty RAM
- CPU instability

16.3 No Charging

Possible Causes

- Damaged charging port
- Faulty charging IC
- Defective battery
- Broken charging flex
- USB cable failure

16.4 No Display

Possible Causes

- Damaged LCD/OLED
- Loose display connector
- Display IC failure
- Backlight circuit fault

16.5 No Network

Possible Causes

- SIM reader failure
- RF circuit damage
- Antenna problem

- Baseband IC fault
 - Software configuration issue
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16.6 Troubleshooting Workflow

Recommended Process

1. Gather customer information.
 2. Inspect the device visually.
 3. Check power and charging.
 4. Measure voltages.
 5. Test suspect components.
 6. Replace faulty parts if necessary.
 7. Verify repair.
 8. Document the work.
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Practical Exercise

Students will diagnose:

- No Power
- No Charging
- Auto Restart
- No Display
- No Network

using professional troubleshooting techniques.

Software & Tools Used

- Digital Multimeter
- DC Regulated Power Supply
- Board View Software
- Mobile Schematics
- Digital Microscope
- CPU-Z (Android)
- USB Current Meter
- Precision Screwdriver Set
- Tweezers

- ESD Wrist Strap
 - ESD Mat
 - Isopropyl Alcohol
 - Hot Air Rework Station (for demonstration)
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Practical Projects

- Motherboard Section Identification
 - Reading Mobile Schematics
 - Board View Component Identification
 - Multimeter Testing
 - Voltage & Continuity Measurement
 - Current Consumption Analysis
 - Short Circuit Detection
 - No Power Diagnosis
 - Common Fault Troubleshooting
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Module Assessment

Assessment	Marks
Quiz	10
Practical Exercises	30
Circuit Diagnosis Project	30
Hardware Fault Troubleshooting	20
Viva	10
Total	100

Module Learning Outcomes

After successfully completing **Module 4: Mobile Circuit & Diagnostics**, students will be able to:

- Explain the structure and function of smartphone motherboards, PCB layers, power circuits, and ground circuits.
- Read and interpret mobile schematics and board view diagrams to locate components and test points.

- Safely use a digital multimeter to perform voltage, resistance, continuity, and diode measurements.
- Use a DC regulated power supply to analyze current consumption, detect short circuits, and diagnose no-power conditions.
- Systematically troubleshoot common smartphone hardware faults, including no power, auto restart, no charging, no display, and no network issues.
- Apply professional diagnostic workflows and documentation practices to identify, verify, and resolve mobile hardware problems in a safe and efficient manner.