# **Program Title**: Bachelor of Engineering (B.Sc. – Engg) in Information and Communication Technology.

# **Program Description:**

# The Bachelor of Science (B.Sc.) in Information and Communication Technology (ICT) is a rigorous 4-year undergraduate program offered by the Department of ICT, Mawlana Bhashani Science and Technology University, Bangladesh. This program is designed under the Outcome-Based Education (OBE) framework to align graduate capabilities with national development goals, global industry demands, and societal needs.

# Students are equipped with both theoretical foundations and practical competencies in computing, electronics, communication systems, software engineering, and emerging technologies such as Artificial Intelligence, Internet of Things (IoT), Cloud Computing, and Cybersecurity. The curriculum ensures a balance between analytical thinking, creative design, ethical awareness, and social responsibility.

# **Learning Framework:**

# The curriculum is structured based on Bloom’s Taxonomy, progressively developing students' cognitive skills from:

# Remembering & Understanding fundamental concepts,

# To Applying & Analyzing complex problems,

# To Evaluating solutions and Creating innovative ICT systems.

# Each course is developed with clearly defined Course Outcomes (COs) that are mapped to broader Program Outcomes (POs), ensuring measurable and meaningful student achievement.

# **Global and Sustainable Orientation:**

# This program supports the vision of the United Nations Sustainable Development Goals (SDGs), particularly:

# SDG 4 – Quality Education: Promoting inclusive, equitable, and industry-relevant ICT education.

# SDG 9 – Industry, Innovation, and Infrastructure: Empowering students with digital skills for resilient and sustainable innovation.

# SDG 11 – Sustainable Cities and Communities: Designing technology-driven solutions that improve urban and rural quality of life.

# SDG 12 – Responsible Consumption and Production: Emphasizing eco-efficient systems, green computing, and ethical data use.

# SDG 13 – Climate Action: Encouraging energy-conscious system design and ICT solutions for environmental monitoring.

# SDG 16 & 17 – Ethics and Partnerships: Embedding professional integrity, teamwork, and global collaboration across projects and learning.

# **Program Highlights:**

# Integrated Learning: Core courses in computer science, electronics, mathematics, and communications.

# Applied Skills: Extensive hands-on labs, software projects, hardware interfacing, and simulations.

# Innovation & Research: Emphasis on final-year thesis, industry internships, and research methodology.

# Soft Skills & Ethics: Courses on professional ethics, communication, economics, and teamwork.

# Global Relevance: Curriculum reviewed against global ICT standards and aligned with national ICT policy.

# **Graduate Attributes:**

# Graduates of this program will be:

# Technologically Competent in solving real-world ICT problems.

# Socially Responsible, contributing to sustainable and ethical technology use.

# Critical Thinkers and Innovators in designing future-ready solutions.

# Effective Communicators and Leaders in diverse and interdisciplinary teams.

# Lifelong Learners committed to continuous self-improvement and societal betterment.

# **Program Outcomes (POs)**

# (Aligned with Bloom’s Taxonomy & UN SDGs)

| **PO No.** | **Program Outcome** | **Bloom Level** | **Mapped SDG** |
| --- | --- | --- | --- |
| PO1 | Knowledge and Comprehension: Demonstrate a solid foundation in mathematics, computing, science, and engineering principles to understand and solve ICT-related problems. | Understand | SDG 4 |
| PO2 | Problem Solving: Identify, analyze, and formulate ICT problems and apply algorithmic and engineering principles to develop effective solutions. | Analyze, Apply | SDG 9 |
| PO3 | Design & Innovation: Design reliable, sustainable, and user-centric ICT systems and solutions considering global, cultural, societal, environmental, and economic constraints. | Create | SDG 9, SDG 11 |
| PO4 | Scientific Inquiry: Conduct experiments and research, interpret and analyze data using scientific methods to support decision-making and innovation. | Evaluate, Analyze | SDG 4, SDG 9 |
| PO5 | Modern Tools & Emerging Technologies: Select and apply appropriate ICT tools, platforms, and techniques including AI, IoT, data analytics, and simulation tools with awareness of their limitations. | Apply, Evaluate | SDG 9 |
| PO6 | Social, Legal & Ethical Responsibility: Understand and evaluate the legal, ethical, social, and cultural impacts of ICT, including privacy, data security, and inclusiveness in the digital era. | Evaluate | SDG 16 |
| PO7 | Sustainability & Environmental Impact: Understand and evaluate the role of ICT in promoting sustainable development, energy-efficient design, and climate-conscious innovation. | Evaluate | SDG 12, SDG 13 |
| PO8 | Ethical Values: Apply ethical reasoning and commit to professional integrity, responsibilities, and standards in ICT practice. | Apply | SDG 16 |
| PO9 | Teamwork & Collaboration: Function effectively in multidisciplinary teams and diverse environments, with the ability to lead and adapt in collaborative ICT projects. | Apply, Create | SDG 17 |
| PO10 | Communication Skills: Communicate effectively with peers, professionals, and society at large through technical writing, reports, presentations, and digital tools. | Apply | SDG 4 |
| PO11 | Entrepreneurship & Project Management: Demonstrate managerial and entrepreneurial skills to lead ICT projects responsibly in diverse professional settings. | Apply, Evaluate | SDG 8, SDG 9 |
| PO12 | Lifelong Learning and Adaptability: Recognize the necessity for continuous self-improvement and knowledge updating in ICT amidst rapidly changing technologies. | Create | SDG 4, SDG 9 |

# **Notes on Integration with SDGs:**

# SDG 4 (Quality Education): Emphasized through learning outcomes, pedagogy, and inclusion of research methods and ethics.

# SDG 9 (Industry, Innovation, and Infrastructure): Embedded through system design, emerging technology, project-based learning.

# SDG 13 (Climate Action) & SDG 12 (Responsible Consumption): Reflected in outcomes addressing sustainability and energy-efficient design.

# SDG 16 & 17: Promote peace, justice, ethics, and teamwork in global partnerships.

# Pedagogical Framework for B.Sc./B.Eng. in Information and Communication Technology

# **Program Duration: 4 Years (8 Semesters) Total Credits: 155 Institution: Mawlana Bhashani Science and Technology University, Bangladesh**

# **1. Pedagogical Vision**

# The pedagogy for the B.Sc./B.Eng. in ICT program is designed to cultivate:

# Critical thinkers and ethical engineers

# Skilled technologists with global and sustainable awareness

# Adaptive lifelong learners equipped to thrive in a digitally transformed world

# The approach blends academic rigor, hands-on practice, interdisciplinary integration, and reflective learning, preparing students for careers in research, innovation, development, and entrepreneurship.

# **2. Pedagogical Pillars**

| Pillar | Description |
| --- | --- |
| Outcome-Based Education (OBE) | All courses defined with COs mapped to POs and PEOs with measurable targets |
| Bloom’s Taxonomy Alignment | Learning progresses from *Remember → Create* across program years |
| SDG Integration | Embedded awareness of sustainable, ethical, and inclusive technology design |
| Industry-Readiness | Labs, projects, internships, and case studies simulate real-world ICT problems |
| Digital-AI Literacy | Responsibly integrated use of tools like AI assistants, simulation platforms |

# 3. Curriculum-Level Pedagogical Strategy

| Year | Focus Area | Bloom’s Level Focus | Pedagogical Focus |
| --- | --- | --- | --- |
| 1st | Foundation in Mathematics, Physics, Programming | Remember → Understand | Conceptual clarity, basic problem solving |
| 2nd | Core computing, algorithms, architecture | Understand → Apply | Algorithmic thinking, lab immersion |
| 3rd | Networking, databases, AI, software engineering | Apply → Analyze | Project-based learning, collaborative skills |
| 4th | Advanced electives, thesis, internship | Analyze → Create | Research, innovation, leadership |

# **4. Pedagogical Tools and Techniques**

| Dimension | Strategy / Tool |
| --- | --- |
| Lecture Delivery | Interactive whiteboard + multimedia + flipped classroom |
| Labs & Practicals | Guided experiments, simulators (Proteus, Tinkercad, Cisco Packet Tracer) |
| Projects | Capstone project, domain-specific mini projects |
| Tutorials | Problem-solving workshops, math and programming clinics |
| Case-based Learning | Ethical hacking, AI bias, sustainable computing scenarios |
| Collaborative Learning | Group reports, peer instruction, code review sessions |
| Blended Learning | Moodle, Google Classroom, YouTube series |
| AI Integration | Critically supervised use of AI tools like ChatGPT, GitHub Copilot |

# **5. SDG-Linked Learning Examples**

| SDG Goal | Curriculum Example |
| --- | --- |
| SDG 4: Quality Education | ICT 1211 – English & Communication, inclusive access tools |
| SDG 9: Industry, Innovation | ICT 4101 – Cybersecurity, ICT 4213 – Wireless Communication |
| SDG 12: Sustainable Production | ICT 2205 – Energy-efficient communication circuits |
| SDG 13: Climate Action | ICT 3205 – Signal Processing for environmental sensors |
| SDG 16/17: Ethics & Partnerships | ICT 3208 – Research Methodology and Professional Ethics |

# **6. Assessment Pedagogy**

| Level | Method | Purpose |
| --- | --- | --- |
| Formative | Weekly quizzes, lab tasks | Identify misconceptions, track learning pace |
| Summative | Mid/final exams, projects | Evaluate knowledge depth and application |
| Continuous | Presentations, participation | Encourage engagement and soft skill growth |
| Reflective | Learning journals, peer feedback | Foster self-awareness and lifelong learning |

# **7. Program-Wide Skills Integration**

| Skill Area | Integration Method |
| --- | --- |
| Problem Solving | Algorithms, circuit analysis, debugging tasks |
| Teamwork | Collaborative projects, group reports |
| Communication | Technical writing, poster presentations, viva voce |
| Leadership & Ethics | Professional ethics, capstone leadership roles |
| Lifelong Learning | Research assignments, tech trend analysis, elective exploration |

# 8. Pedagogical Responsiveness to Generative AI

| Challenge (AI Age) | Pedagogical Response |
| --- | --- |
| Over-reliance on AI tools | Manual + AI cross-validation in assignments |
| Surface-level understanding | Emphasis on “explain in your own words” & viva justification |
| Critical evaluation gaps | Compare AI vs human-generated solutions |
| Plagiarism risks | Promote integrity with citation training + originality checks |

# **9. Example Pedagogical Techniques by Course Type**

| Course Type | Techniques Used |
| --- | --- |
| Theory (3.0 Cr) | Problem-solving sessions, flipped videos, think-pair-share |
| Lab (1.0 Cr) | Pre-lab quizzes, live demos, peer circuit evaluation |
| Project/Thesis | Agile methodology, weekly standups, progress defense |
| Humanities | Case studies, open discussions, role plays (e.g., ICT policy debates) |

# 10. Program Learning Cycle

# Learn → Apply → Reflect → Communicate → Create

# This learning cycle is embedded across years and courses using diverse pedagogical assessments, tools, and delivery methods.

# List of Courses at a glance

## First Year First Semester

|  |  |  |
| --- | --- | --- |
| Course Code | Course Title | Credit |
| ICT 1101 | Basic Electrical Circuits | 3 |
| ICT 1102 | Basic Electrical Circuits Lab | 1 |
| ICT 1103 | Computer Programming | 3 |
| ICT 1104 | Computer Programming Lab | 1 |
| ICT 1105 | Physics | 3 |
| ICT 1107 | Differential and Integral Calculus | 3 |
| ICT 1109 | Chemistry | 3 |
| ICT 1111 | History of the Emergence of Bangladesh | 3 |

Total Credits: 20

## First Year Second Semester

|  |  |  |
| --- | --- | --- |
| Course Code | Course Title | Credit |
| ICT 1201 | Electronic Devices and Circuit Theory | 3 |
| ICT 1202 | Electronic Devices and Circuit Theory Lab | 1 |
| ICT 1203 | Data Structure | 3 |
| ICT 1204 | Data Structure Lab | 1 |
| ICT 1205 | Discrete Mathematics | 3 |
| ICT 1207 | Matrices and Coordinate Geometry | 3 |
| ICT 1209 | Information Theory | 3 |
| ICT 1211 | English Language and Literature | 3 |
| ICT 1200 | Project - I | 1 |

Total Credits: 21

## Second Year First Semester

|  |  |  |
| --- | --- | --- |
| Course Code | Course Title | Credit |
| ICT 2101 | Computer Organization and Architecture | 3 |
| ICT 2102 | Computer Based Numerical Methods Lab | 1.5 |
| ICT 2103 | Digital Logic Design | 3 |
| ICT 2104 | Digital Logic Design Lab | 1 |
| ICT 2106 | Object Oriented Programming Lab | 1.5 |
| ICT 2107 | Algorithms Analysis and Design | 3 |
| ICT 2108 | Algorithms Analysis and Design Lab | 1 |
| ICT 2109 | Differential Equations and Vector Calculus | 3 |
| ICT 2111 | Statistics for Engineers | 3 |

Total Credits: 20

## Second Year Second Semester

|  |  |  |
| --- | --- | --- |
| Course Code | Course Title | Credit |
| ICT 2201 | Operating System | 3 |
| ICT 2202 | Operating System Lab | 1 |
| ICT 2203 | Microprocessor and Embedded Systems | 3 |
| ICT 2204 | Microprocessor and Embedded Systems Lab | 1 |
| ICT 2205 | Communication Engineering | 3 |
| ICT 2206 | Communication Engineering Lab | 1 |
| ICT 2207 | Object Oriented Pattern and Design | 3 |
| ICT 2208 | Object Oriented Pattern and Design Lab | 1 |
| ICT 2211 | Complex Variables and Fourier Analysis | 3 |
| ICT 2213 | Economics and Managerial Accounting | 3 |
| ICT 2200 | Project - II | 1 |

Total Credits: 23

## Third Year First Semester

|  |  |  |
| --- | --- | --- |
| Course Code | Course Title | Credit |
| ICT 3101 | Data Communication | 3 |
| ICT 3102 | Data Communication Lab | 1 |
| ICT 3103 | Database Management System | 3 |
| ICT 3104 | Database Management System Lab | 1 |
| ICT 3105 | Artificial Intelligence and Expert Systems | 3 |
| ICT 3106 | Artificial Intelligence and Expert Systems Lab | 1 |
| ICT 3107 | Software Engineering | 3 |
| ICT 3108 | Software Engineering Lab | 1 |
| ICT 3109 | Theory of Computation | 3 |
| ICT 3100 | Project - III | 1 |

Total Credits: 20

## Third Year Second Semester

|  |  |  |
| --- | --- | --- |
| Course Code | Course Title | Credit |
| ICT 3200 | Industrial Visit / Tour | 1 |
| ICT 3201 | Computer Networks | 3 |
| ICT 3202 | Computer Networks Lab | 1 |
| ICT 3203 | Web Application Development | 3 |
| ICT 3204 | Web Application Development Lab | 1 |
| ICT 3205 | Digital Signal Processing | 3 |
| ICT 3206 | Digital Signal Processing Lab | 1 |
| ICT 3207 | Statistics and Data Science | 3 |
| ICT 3208 | Research Methodology and Professional Ethics | 2 |
| ICT 3211 | Comprehensive Oral Examination | 1 |

Total Credits: 18

## Fourth Year First Semester

|  |  |  |
| --- | --- | --- |
| Course Code | Course Title | Credit |
| ICT 4000 | Project / Thesis | 3 |
| ICT 4101 | Cryptography and Cyber Security | 3 |
| ELECTIVE I | 3 × Elective I (Theory + Lab) | 12 |

Total Credits: 18

## Fourth Year Second Semester

|  |  |  |
| --- | --- | --- |
| Course Code | Course Title | Credit |
| ICT 4000 | Project / Thesis | 3 |
| ICT 4200 | Internship / 3 × Elective - II Courses | 12 |

Total Credits: 15

# **ICT 1101 – Basic Electrical Circuits and Lab (ICT-1102)**

**Credit: 4.0 (Theory: 3.0 and Practical: 1.0)  
Level: Undergraduate – First Year, First Semester  
Contact Hours: 3 hours/week  
Duration: 12 Weeks (1st Semester)**

## **Course Description**

This foundational course introduces undergraduate students to the core principles of electrical circuits—a critical pillar for advancing in information and communication technologies. Students will explore essential concepts such as voltage, current, resistance, energy, Ohm’s Law, Kirchhoff’s Laws, circuit simplification techniques, and basic circuit theorems (Thevenin, Norton, Superposition).

Structured under the Outcome-Based Education (OBE) model, this course emphasizes learning outcomes that guide students through progressively complex cognitive levels as defined by Bloom’s Taxonomy: starting from remembering fundamental laws, understanding circuit behavior, applying analysis techniques, to evaluating circuit responses and ultimately designing efficient systems.

In the context of the United Nations Sustainable Development Goals (SDGs), particularly:

* SDG 4: Quality Education
* SDG 9: Industry, Innovation and Infrastructure, and
* SDG 12: Responsible Consumption and Production,  
  this course nurtures responsible and sustainable thinking through energy-efficient design and ethical application of electrical knowledge in ICT systems.

This course introduces the fundamental concepts of electrical circuits. Students will learn about electric charge, voltage, current, resistance, Ohm's Law, Kirchhoff's Laws, and network theorems. The course covers both DC and AC circuit analysis techniques and emphasizes problem-solving and circuit behavior analysis.

## **Course Outcomes (COs)**

Aligned with Bloom’s Taxonomy levels and designed to assess knowledge, application, and analysis skills.

| CO No. | Course Outcome Statement | Bloom’s Level |
| --- | --- | --- |
| CO1 | Explain basic concepts of electric charge, current, voltage, resistance, power, and energy | Understand |
| CO2 | Apply Ohm’s Law and Kirchhoff’s Laws to analyze resistive circuits | Apply |
| CO3 | Analyze DC circuits using mesh current and nodal voltage techniques | Analyze |
| CO4 | Simplify circuits using Superposition, Thevenin, Norton, and Source Transformation methods | Analyze |
| CO5 | Explain and interpret the behavior of capacitors, inductors, transient responses, and AC sinusoidal circuits | Understand, Analyze |

## **12-Week Course Content & Completion Plan**

Each week includes:

* 3 Lectures (T1, T2, T3)
* 2 Practical Sessions (P1, P2) for 2 sections

Week 1

* T1-T3: Introduction to electric circuits, basic quantities (charge, current, voltage, power, energy), circuit symbols
* P1-P2: Lab intro, safety, component ID, multimeter and breadboard basics

Week 2

* T1-T3: Ohm’s Law, Resistance combinations, voltage and current division
* P1-P2: Measure resistance and voltage in series/parallel circuits

Week 3

* T1-T3: Kirchhoff’s Current Law (KCL) and Voltage Law (KVL)
* P1-P2: Verification of KCL & KVL using resistor networks

Week 4

* T1-T3: Node Voltage and Mesh Current Methods
* P1-P2: Circuit analysis using mesh and nodal methods
* Class Test/Quiz 1

Week 5

* T1-T3: Star-Delta conversion, practical application of analysis techniques
* P1-P2: Star-Delta conversion and equivalent resistance verification

Week 6

* T1-T3: Superposition Theorem, Source Transformation
* P1-P2: Practical demonstration of superposition principle

Week 7

* T1-T3: Thevenin and Norton’s Theorems
* P1-P2: Find Thevenin/Norton equivalents in circuits

Week 8

* T1-T3: Maximum Power Transfer Theorem and applications
* P1-P2: Max power transfer lab experiment
* Class Test/Quiz 2

Week 9

* T1-T3: Introduction to capacitors and inductors, charging/discharging
* P1-P2: Measure time constants of RC and RL circuits

Week 10

* T1-T3: Transient response in first-order RL and RC circuits
* P1-P2: Plot and analyze transient graphs using oscilloscope

Week 11

* T1-T3: Sinusoidal sources, phasors, impedance, and reactance
* P1-P2: Use signal generators and measure AC waveforms

Week 12

* T1-T3: Series and parallel RLC circuits, resonance
* P1-P2: Resonance experiments (frequency response curves)
* Class Test/Quiz 3

## **Summary Structure**

| Week | Theory Topics | Practical Topics | Assessment |
| --- | --- | --- | --- |
| 1 | Basic quantities, units | Lab intro, measurements | – |
| 2 | Ohm’s Law, series-parallel | Resistance measurements | – |
| 3 | KCL, KVL | Verification of laws | – |
| 4 | Mesh & Nodal Analysis | Application of methods | Quiz 1 |
| 5 | Star-Delta, equivalent circuits | Circuit simplification | – |
| 6 | Superposition, Source Transform | Lab verification | – |
| 7 | Thevenin & Norton | Equivalent circuits | – |
| 8 | Max Power Transfer | Application in lab | Quiz 2 |
| 9 | Capacitors, Inductors | Time constant behavior | – |
| 10 | Transients | RC/RL circuit response | – |
| 11 | Phasors, AC circuits | Oscilloscope, AC lab | – |
| 12 | Resonance | Frequency response curves | Quiz 3 |

## **CO-PO Mapping Table**

(✓ indicates alignment of Course Outcome (CO) with Program Outcome (PO))

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CO \ PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| CO1 | ✓ |  |  |  |  |  |  |  |  |  |  | ✓ |
| CO2 | ✓ | ✓ |  |  | ✓ |  |  |  |  |  |  | ✓ |
| CO3 | ✓ | ✓ | ✓ |  | ✓ |  |  |  |  |  |  | ✓ |
| CO4 | ✓ | ✓ | ✓ | ✓ | ✓ |  |  | ✓ |  | ✓ | ✓ | ✓ |
| CO5 | ✓ | ✓ | ✓ | ✓ | ✓ |  | ✓ | ✓ |  | ✓ |  | ✓ |

## **ICT 1101 – Basic Electrical Circuits (Theory – 100 Marks)**

**Assessment Breakdown**

| Assessment Item | Marks | Weight (%) | Target COs | Assessment Methods |
| --- | --- | --- | --- | --- |
| Class Tests / Quizzes (3) | 30 | 30% | CO2, CO3, CO4 | Short problems, MCQs, numerical analysis, circuit sketching |
| Attendance | 10 | 10% | All COs indirectly | Based on regularity, engagement, participation |
| Final Exam | 60 | 60% | CO1–CO5 | Conceptual, analytical, and problem-solving questions |
| Total | 100 | 100% | — | — |

## **Rubrics for ICT 1101 (Theory)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Component | Excellent (80–100%) | Good (60–79%) | Satisfactory (40–59%) | Needs Improvement (<40%) |
| Class Tests / Quizzes | Accurately solves and explains multi-step circuit problems | Solves correctly but may miss interpretation | Solves basic circuits with guidance | Fails to apply laws, lacks basic understanding |
| Attendance | Present in >90% of classes with active participation | Present in 80–89%, minor lapses | Present in 70–79% | Poor attendance (<70%) |
| Final Exam | Demonstrates full conceptual and analytical understanding | Understands core ideas but with small errors | Partial understanding, relies on memorization | Misapplies theory, unable to solve key problems |

## **ICT 1102 – Basic Electrical Circuits Lab (100 Marks)**

Assessment Breakdown

**Part A (50 Marks) – Continuous & Reflective Learning**

| Assessment Item | Marks | Weight (%) | Target COs | Methods |
| --- | --- | --- | --- | --- |
| Attendance | 10 | 10% | CO1, CO2 | Based on lab presence and punctuality |
| Quiz (Lab-focused) | 20 | 20% | CO2, CO4 | Basic calculations, observation-based |
| Report Submission | 20 | 20% | CO3, CO5 | Lab journals, circuit diagrams, analysis |

**Part B (50 Marks) – Competency and Technical Evaluation**

| Assessment Item | Marks | Weight (%) | Target COs | Methods |
| --- | --- | --- | --- | --- |
| Lab Final Exam | 20 | 20% | CO2, CO4 | Breadboard tasks, instrument setup, measurements |
| Continuous Assessment | 20 | 20% | CO1–CO5 | Lab tasks, peer interaction, weekly preparation |
| Viva Voce | 10 | 10% | CO1–CO5 | Oral questioning, circuit reasoning |

## **Rubrics for ICT 1102 (Lab)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Component | Excellent (80–100%) | Good (60–79%) | Satisfactory (40–59%) | Needs Improvement (<40%) |
| Report | Complete, accurate, well-organized, uses correct terminology | Minor errors in values/formatting | Incomplete analysis or unclear diagrams | Missing steps, careless or plagiarized work |
| Lab Performance | Works independently, accurate measurements, handles instruments well | Few minor errors, needs minor instructor support | Needs guidance for setup, low confidence | Unsafe handling or no meaningful output |
| Viva | Clear understanding and reasoning behind circuits | Answers basic questions, some struggle with reasoning | Limited answers, guesses, lacks reasoning | Cannot respond or explain circuits |

## **Rubrics for Each CO (Performance Criteria)**

CO1: Explain fundamental electrical quantities

* Excellent (80–100%): Can clearly define and relate all basic concepts with correct units.
* Good (60–79%): Mostly accurate with minor conceptual errors.
* Satisfactory (40–59%): Basic terms remembered but confused in application.
* Below (0–39%): Cannot define terms or relate them correctly.

CO2: Apply Ohm’s and Kirchhoff’s Laws

* Excellent: Accurately applies laws to multi-branch circuits.
* Good: Correctly applies laws with some algebraic or unit mistakes.
* Satisfactory: Can solve only simple circuits with assistance.
* Below: Unable to formulate or solve circuit equations.

CO3: Analyze using mesh/nodal methods

* Excellent: Can set up and solve complex systems of equations independently.
* Good: Sets up equations but makes calculation errors.
* Satisfactory: Needs guided steps or formula sheet.
* Below: Cannot perform analysis or identify elements.

CO4: Evaluate using circuit theorems

* Excellent: Applies all three theorems to simplify and solve.
* Good: Applies one or two correctly.
* Satisfactory: Understands conceptually but struggles with formulation.
* Below: Does not recognize when to use theorems.

CO5: Interpret reactive elements and AC behavior

* Excellent: Understands phasor relationships and frequency impact.
* Good: Knows reactance but struggles with circuit behavior.
* Satisfactory: Understands time domain effects.
* Below: No clear idea of capacitive or inductive effects.

## **Final Exam SAMPLE Questions with CO-PO Mapping**

**Question 1: Circuit Analysis using Mesh and Nodal Techniques**

Q1. For the circuit shown below, apply mesh analysis to determine the current through each branch. Then, use nodal analysis to calculate the voltage at all essential nodes.  
*(Provide both hand-sketched or printed circuit if in paper exam)*

[12 Marks]

* Mapped CO: CO3 – Analyze DC circuits using mesh current and nodal voltage techniques
* Mapped PO(s): PO1 (Knowledge), PO2 (Problem Analysis), PO3 (Design/Development), PO5 (Modern Tools)
* Bloom Level: Analyze

Question 2: Application of Theorems in Circuit Simplification

**Q2. Given a multi-source resistive circuit,**  
*a) Apply the Superposition Theorem to find the voltage across a 4Ω resistor.  
b) Find the Thevenin equivalent circuit as seen from terminals A–B and compute the load current through a 6Ω resistor connected across A–B.*

[12 Marks]

* Mapped CO: CO4 – Simplify circuits using Thevenin, Norton, and Superposition theorems
* Mapped PO(s): PO1, PO2, PO4 (Investigation), PO10 (Communication, if presentation is required)
* Bloom Level: Analyze, Evaluate

**Question 3: Transient and AC Circuit Interpretation**

Q3.  
*a) A 10 μF capacitor is charged to 5V and discharged through a 1kΩ resistor. Derive the equation for voltage across the capacitor over time and sketch the response.  
b) A sinusoidal AC source is applied to an RLC series circuit. Derive the expression for total impedance and find the resonance frequency.*

[12 Marks]

* Mapped CO: CO5 – Interpret capacitive, inductive, transient, and AC responses
* Mapped PO(s): PO1, PO2, PO5, PO7 (Sustainability), PO12 (Lifelong Learning)
* Bloom Level: Understand, Analyze, Evaluate

**Summary Table**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Question | CO | PO(s) | Bloom Level | Marks |
| Q1 – Mesh & Nodal Analysis | CO3 | PO1, PO2, PO3, PO5 | Analyze | 12 |
| Q2 – Superposition & Thevenin | CO4 | PO1, PO2, PO4, PO10 | Analyze, Evaluate | 12 |
| Q3 – Transients & AC | CO5 | PO1, PO2, PO5, PO7, PO12 | Understand, Analyze | 12 |