SEMESTER - 6

Comprehensive Lesson Plan: Electrical Circuits and Network Skills

(SEC -4)

Overall Learning Objectives:

- Understand the fundamental concepts of electricity: voltage, current, resistance, and power.
- Apply Ohm's Law to analyze electrical circuits.
- Differentiate between AC and DC electricity and their applications.
- Interpret electrical schematics and symbols.
- Explain the operation of generators, transformers, and electric motors.
- Describe the functions of basic solid-state devices and their applications in circuits.
- Implement electrical protection methods to ensure safety and circuit integrity.
- Understand different types of electrical wiring and installation practices.

Materials and Resources:

- Textbook: Basic Electricity by Van Valkenburgh or similar resource.
- Lecture slides and handouts with diagrams and illustrations.
- Multimeters, ammeters, and voltmeters (for demonstrations and labs).
- Circuit simulation software (optional).
- Breadboards and electrical components (resistors, capacitors, inductors, diodes) for optional hands-on activities.
- Extension cords, wires, and basic wiring materials (for demonstrations).

Assessment/Evaluation:

- Quizzes and assignments throughout the course to assess understanding of concepts.
- Internal exam covering Units 1-3.
- Final exam covering all units.
- Laboratory reports documenting experiments and results (if applicable).
- Short presentations on assigned topics (optional).

Differentiation:

- Provide real-world examples and applications of electrical concepts to enhance engagement.
- Offer opportunities for hands-on activities and labs to cater to kinesthetic learners.
- Use clear visuals, diagrams, and animations to support visual learners.
- Break down complex topics into smaller steps and provide additional practice problems for struggling students.
- Encourage advanced learners to research specific areas of interest in electricity and present their findings.

Lecture Schedule:

Unit 1: Basic Electrical Principles (8 Lectures)

- Learning Objectives:
  - Define voltage, current, resistance, and power.
  - Explain the relationship between these quantities using Ohm's Law.
  - Differentiate between series and parallel circuits.
  - Calculate voltage and current in series and parallel circuits.
  - Identify AC and DC electricity and their basic characteristics.
  - Understand the use of multimeters, ammeters, and voltmeters for electrical measurements.

- Activities:
  - Interactive demonstrations of voltage, current, and resistance using simulations or simple circuits.
  - Practice problems applying Ohm's Law to various circuit scenarios.
  - Group activities to analyze series and parallel circuits (voltage and current calculations).
  - Introduction to AC and DC electricity with real-world examples (animations or videos).
  - Hands-on training on using multimeters to measure voltage, current, and resistance (if applicable).

Unit 2: Electrical Circuits Analysis (8 Lectures)

- Learning Objectives:
  - Understand basic electrical circuit elements (resistors, capacitors, inductors).
  - Analyze DC circuits using Kirchhoff's Current Law (KCL) and Kirchhoff's Voltage Law (KVL).
  - Calculate voltage drops and currents across different circuit elements.
  - Explain the concept of single-phase and three-phase AC power sources.
  - Analyze AC circuits using basic principles (impedance, reactance).
  - Understand the concept of real, imaginary, and complex power in AC circuits.
  - Explain the importance of power factor and its impact on energy efficiency.
- Activities:
  - Introduction to resistors, capacitors, and inductors with demonstrations of their properties.
  - Application of KCL and KVL to solve DC circuit problems (practice worksheets).
  - Analysis of voltage and current distribution in DC circuits with multiple elements.
  - Introduction to single-phase and three-phase AC power systems (diagrams and animations).

- Explanation of impedance and reactance in AC circuits (graphical representations).
- Power calculations in AC circuits (real, imaginary, and complex power).
- Discussion on power factor and its influence on energy consumption.

Unit 3: Electrical Schematics and Applications (6 Lectures)

- Learning Objectives:
- Interpret electrical symbols and schematics used in circuit diagrams.
- Read and understand blueprints and ladder diagrams.
- Differentiate between power and control circuits in electrical systems.
- Trace current flow and voltage drops in electrical schematics.
- Explain the operation of generators and transformers in power systems.
- Understand the basic principles of electric motors (AC and DC).
- Activities:
- Introduction to electrical symbols and components through standard libraries.
- Exercises in reading and interpreting basic electrical schematics.
- Analysis of blueprints and ladder diagrams used in electrical installations.
- Distinguishing between power and control circuits based on function.
- Group activities to trace current flow and analyze voltage drops in simple circuits using schematics.
- Lectures and discussions on the operation of generators (DC and AC), transformers (types and applications), and different types of electric motors (DC motors, AC motors: single-phase, three-phase).

Unit 4: Solid-State Devices (3 Lectures)

- Learning Objectives:
- Understand the characteristics of resistors, inductors, and capacitors.
- Analyze the behavior of diodes and rectifiers in AC and DC circuits.
- Understand the response of inductors and capacitors to AC and DC sources.

- Activities:
  - Review of basic circuit elements: resistors, inductors, and capacitors.
  - Analysis of diode characteristics (forward and reverse bias) and applications (rectification).
  - Discussion on the response of inductors and capacitors to AC and DC sources (impedance, phase shift).
  - Simple circuit analysis problems involving diodes, capacitors, and inductors.

Unit 5: Electrical Protection (4 Lectures)

- Learning Objectives:
  - Understand the importance of electrical safety and protection.
  - Explain the function of relays, fuses, and circuit breakers.
  - Understand the principles of ground-fault protection and grounding.
  - Analyze the impact of surge protection devices.
  - Understand the role of electrical isolation.
  - Explore methods of interfacing DC or AC sources to control elements (relay protection devices).
- Activities:
  - Discussion on electrical safety hazards and protective measures.
  - Analysis of different types of fuses, circuit breakers, and relays.
  - Explanation of ground-fault protection and grounding techniques.
  - Discussion on surge protection devices and their applications.
  - Case studies on electrical accidents and their prevention.
  - (Optional) Demonstration or simulation of basic relay circuits.

Unit 6: Electrical Wiring (5 Lectures)

- Learning Objectives:
  - Understand different types of conductors and cables used in electrical wiring.
  - Understand basic wiring practices: Star and delta connections.

- Analyze voltage drop and power losses in cables.
- Understand the importance of proper insulation and grounding.
- Learn about different wiring methods (conduit, cable trays).
- Understand the principles of wire splicing and termination techniques (wire nuts, crimps, terminal blocks, split bolts, solder).
- Learn basic procedures for preparing an extension board.

- Activities:
- Introduction to different types of conductors (copper, aluminum) and cables (stranded, solid, shielded).
- Discussion on wiring practices: Star and delta connections, grounding techniques.
- Calculation of voltage drop and power losses in cables.
- Demonstration of various wire splicing techniques (if feasible).
- Hands-on activity: Preparing a simple extension board.
- Discussion on electrical codes and safety regulations.

Closure:

- Review and Summary:
- Conduct a comprehensive review of all topics covered in the course.
- Address any remaining student questions.

- **Final Exam:**
- Assess student understanding of all topics covered in the course.
- Include theoretical questions, problem-solving, and short-answer questions.

Note:

- The number of lectures for each unit can be adjusted based on the specific needs and pace of the course.
- Hands-on activities, laboratory experiments, and real-world examples should be incorporated whenever possible to enhance learning.

- Regular quizzes and assignments throughout the course will help reinforce learning and provide feedback to students.