Unit 1

Introduction

We all know that now a days Electronics is the fastest developing discipline in the field of science and technology. It affects all fields of life and improves human life style. More over it simplifies our daily activities and provides more and more facilities.

Therefore as an introductory chapter content transactions should be such that the students are motivated to be more interested and curious to enter into the field of electronic technology. In this chapter the definition, history, applications and significance of Electronics in daily life are revealed to students through general discussion, demonstration of components data collection and chart preparation.

Attitudes and Values

The technology we use and develop should be for the betterment of our life. While discussing the areas of application, the teacher may give emphasis to the point that the knowledge in technology should not be used for destructive purposes. The knowledge in internet technology and networking should not be used for hacking useful websites. The knowledge in software development should not be used for creating virus programs. Thus along with imparting knowledge to the students, care must be given to mould better citizens for the nation.
### Unit Frame - I

<table>
<thead>
<tr>
<th>Concepts/Process skills</th>
<th>Process/Activities with Assessments</th>
<th>Learning outcomes</th>
</tr>
</thead>
</table>
| Invention of electronic devices and the development of Electronics.  
  • Communicating  
  • Understanding  
  • Communication of others.  
Importance of electronic technology in the modern world.  
  • Observing  
  • Interpreting data  
Concept of different areas of applications of electronics.  
  • Observing  
  • Classifying |  
  • General discussion  
  • Demonstration of Electronic components.  
  • Chart preparation by collecting electronic devices used in our day to day life.  
  • Preparation of chart  
  • Data collection on the applications of electronics  
  • Participation in general discussion  
  • Involvement in collecting and demonstrating components  
  • Content and quality of chart presented |  
  • Explains the origin and history of the development of Electronics.  
  • Point out the significance of Electronics in day to day life.  
  • Classify the applications of Electronics in various fields. |
| Classification as active and passive devices  
  • Identifying  
  • Classifying  
Constructional features of passive components.  
  • Observing  
  • Identifying |  
  • Collection of electronic components.  
  • Classification of components as active and passive.  
  • Demonstration of devices. |  
  • Classify the important components in electronics as active and passive.  
  • Recognise, resistors, capacitors and inductors of various types from their physical appearance. |
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</tr>
</thead>
</table>
| Concept of colour coding technique used for resistors  
  - Observing  
  - Interpreting data  
  - Identifying | • Preparation of colour coding table  
  • Problem solving using the values of codes. | • Identify the value of resistors using their colour coding.                      |
| Symbols used for representing electronic components.  
  - Observing  
  - Sketching  
  Concept of specifications of different types of resistors, capacitors and inductors.  
  - Observing  
  - Measuring  
  - Calculating | • Collection of circuit diagrams using ICT and identification of the symbols of components.  
  • Collection of various types of resistors, capacitors and inductors, categorising and recording | • Draw the symbols of different active and passive components.  
  • Explain the specifications of various types of resistors, capacitors and inductors. |
|                                                      | • Skill in finding out the resistance value using colour code.  
  • Ability to identify different components.  
  • Content and quality of chart prepared. |                                                                                   |
|                                                      | • Assignment based on the history and development of electronics.  
  • Frame multiple choice questions based on this unit. |                                                                                   |
The origin and history of development of Electronics

Suggested Activity 1.1
Demonstration and general discussion

Students collect and demonstrate electronic components such as vacuum tubes, diodes, transistors, IC's etc. Some components may be taken from the laboratory for demonstration.

Discussion points

- Have you seen all these components earlier?
- Tell the name of each component.
- Which component was invented first?
- What is the significance of development of each component?

Now the teacher consolidates details about the origin and history of development of electronics. Teacher also introduces the stages of development of IC's such as SSI, MSI, LSI, VLSI etc.

Applications of Electronics

Suggested Activity 1.2
Data Collection and Chart preparation

Students are divided into 5 groups and are advised to notice the applications of electronics in various sectors and prepare a note on the data obtained. Then they are advised to prepare charts showing different fields and applications of electronics in each field.

Now a discussion is conducted.

Discussion points

- What are the applications of electronics in medical field?
- What is RADAR? In which field is its application?
- What are the electronic communication systems used world wide?

Consolidation

Teacher verifies every chart made by each group and finalises the required chart and consolidates the applications of electronics in various fields.
Work sheet

Complete the table

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Field of application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobile phone</td>
<td>........................................</td>
</tr>
<tr>
<td></td>
<td>Defence</td>
</tr>
<tr>
<td></td>
<td>Consumer Electronics</td>
</tr>
<tr>
<td>CRO</td>
<td>........................................</td>
</tr>
<tr>
<td>ECG</td>
<td>........................................</td>
</tr>
</tbody>
</table>

T.E. Questions

Multiple Choice Questions

I
(1) Select the oddman from the following
   a. Inductor       b. PN junction diode  c. Transistor       d. Zener diode

(2) Separate the following devices as active and passive
   Transformer, Electric bulb, Inductor, Resistor, Trimmer, Capacitor, Transistor, Amplifier, IC’s, OP-AmP

II
(1) mH stands for the unit of

(2) Number of turns in the primary and secondary coils of a transformer differ comment on this.

III.
(1) A 100 Ω resistance can be represented by the three colours as per colour coding which are
(2) A resistor has the following colour codes. Refering your textbook or notebook find its resistance. (Black, Brown, Yellow, Silver).

IV
(1) The electronic component which passes AC and blocks DC is
   a. Resistor    b. Capacitor    c. Inductor    d. Transistor
(2) Surface area of the conducting plates and the distance between the plates seriously affect the capacitance of a capacitor. Do you agree? Explain.

V
(1) The medical instrument used to determines the condition of heart of a patient is
   a. X-ray    b. EEG    c. ECG    d. MRI Scan
(2) Draw the symbols of
   a. Resistor    b. Capacitor    c. Inductor    d. Electrolytic Capacitor
   e. Variable Capacitor    f. Iron core inductor    g. Ferrite core inductor

VI. The capacitive reactance is given by
   a. $\frac{1}{2\pi fC}$    b. $\frac{2\pi f}{L}$    c. $2\pi fC$    d. $\frac{1}{2\pi fL}$

VII.
(1) The voltage ratings of ceramic capacitors are approximately
   a. 3 V - 50 V    b. 0.3 V - 100 V    c. 30 V - 300 V    d. 3 V - 6000 V
(2) Trimmer is a
   a. Variable resistor    b. Variable Capacitor
   c. Variable inductor    d. Fixed resistor
(3) Rheostat is a
   a. Fixed Capacitor    b. Variable Capacitor
   c. Fixed Resistor    d. Variable Resistor
P.E Items

1. Various electronic components are given and the students are requested to identify them.

2. Students are requested to classify the given components into active and passive ones.

3. Certain number of resistors are given to students and they are requested to identify their values.

Reference

1. Principles of Electronics - V.K. Mehta, Rohit Mehta (S. Chand & Company)

2. Basic Electronics and Linear Circuits - N.N. Bhargava, D.C. Kulshreshta

3. Electronic Principles - Malvino

ICT

www.electronics.tutorials.ws
www.components.about.com/od/components
www.allaboutcircuit.com
Introduction
In order to continue studies in Electronics it is a must for students to learn the basic concepts of electricity. This chapter deals with the concepts of voltage, current and electric power. It also discusses with the series and parallel combinations of resistors and capacitors, ohm’s law and Kirchhoff’s law. Students may internalize all these concepts through observation, circuit assembling, problem solving, demonstration and general discussions.

Attitudes and Values
When worksheets are given to the students to do the exercise, it can be noted that some students are doing it fast and correct but they are not ready to disclose or share the ideas to their friends. In such cases, the teacher may take necessary initiative to inspire those students to share the ideas they acquired to their friends. It will develop a social feeling among the students.
## Unit Frame - II

<table>
<thead>
<tr>
<th>Concepts/Process skills</th>
<th>Process/Activities with Assessments</th>
<th>Learning outcomes</th>
</tr>
</thead>
</table>
| Basic concept of electrical parameters - voltage, current and power.  
  • Experimenting  
  • Observing  
  Concept of Ohm’s law  
  • Plotting graph  
  Effective resistance and effective capacitance of an electric circuit.  
  • Analysing  
  • Calculating  |  
  • Demonstration of electric circuit.  
  • Observation of current flow through the circuit measurement of voltage and current.  
  • Assembling of circuit  
  • Measurement of voltage and current.  
  • Graphical representation  
  • Drawing circuit diagrams  
  • Problem solving  |  
  • Differentiates the basic parameters of electricity.  
  • Utilise Ohm’s law for solving electric circuits.  
  • Solve electrical networks.  |
| Basics of Kirchoff’s voltage and current laws  
  • Communicating  
  • Calculating  
  Concept of how practical electric sources differs from ideal sources.  
  • Communicating  
  • Predicting  
  Characteristics of AC and DC voltages.  
  • Observing  
  • Inferring  |  
  • Participation in measuring values  
  • Ability to draw circuit diagrams and graph  
  • Skills in problem solving  
  • General discussion on KCL & KVL  
  • Problem solving  |  
  • Solve networks using Kirchoff’s laws.  
  • Explain the characteristics of ideal voltage and current source.  
  • Distinguish between DC & AC voltages.  |
<table>
<thead>
<tr>
<th>Concepts/Process skills</th>
<th>Process/Activities with Assessments</th>
<th>Learning outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Characteristics of AC voltage wave form.</td>
<td>• Preparing chart of AC &amp; DC sources.</td>
<td>• Explains the characteristics such as frequency and phase of AC voltages.</td>
</tr>
<tr>
<td>• Plotting graph</td>
<td>• Drawing wave forms of different characters.</td>
<td></td>
</tr>
<tr>
<td>• Communication</td>
<td>• General discussion based on different drawings.</td>
<td></td>
</tr>
<tr>
<td>Different values of AC voltages</td>
<td>• Quality of charts prepared.</td>
<td></td>
</tr>
<tr>
<td>• Calculating</td>
<td>• Ability to analyse AC and DC wave forms.</td>
<td></td>
</tr>
<tr>
<td>Concept of reactance's in AC circuits and the formula for calculating impedance.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Communication and understanding communication of others.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• General discussion on different values.</td>
<td>• Problem solving</td>
<td>• Explains the significance of RMS and Average values.</td>
</tr>
<tr>
<td>• Group discussion on the effects of passive components in AC circuits.</td>
<td>• General discussion on the effect of combination of passive components in circuits.</td>
<td>• Explains the concept of impedance.</td>
</tr>
<tr>
<td>• Skills in problem solving.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Participation in group discussion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Seminar based on the concept of impedance</td>
<td>• Class test based on this unit.</td>
<td></td>
</tr>
</tbody>
</table>
Towards the unit

Basic concepts of Electricity

Suggested Activity 2.1

Demonstration of a basic electric circuit

Students are divided into 5 groups and each group is advised to assemble the following circuit in the laboratory. Teacher should help students to do the activity.

Now a general discussion is conducted.

Discussion points

- What is the reading on the meter connected across the bulb?
- What does it mean?
- What is the reading on the meter in series with the circuit?
- What does it mean?
- What happens when the switch is closed and when it is opened?

Consolidation

The teacher consolidates the definition and significance of voltage, current and electric power.

Concept of Ohm’s law.

Suggested Activity 2.2

Demonstration of an electric circuit

In the circuit used for activity 1 instead of fixed supply, a 0-30 V variable power supply is used and the bulb is replaced by a resistance. Students in groups are requested to do the following.

- Vary supply voltage in steps from 0V onwards.
- Observe the voltmeter and ammeter reading in each step.
- Prepare a tabular column using volt meter and ammeter readings.
- Observe the data obtained.
- Draw a graph with voltage on the X-axis and current on the Y axis.
- Observe the graph.
Electronics XI

Consolidation

The teacher consolidates Ohm's law and helps students to solve certain problems using ohm's law.

Basic concepts of Kirchoff’s laws

Suggested Activity 2.3

General discussion

A general discussion on the drawbacks of ohm’s law is conducted.

Discussion points

- Memorise the limitations of ohm's law using previous knowledge.
- Is it possible to solve a network with two or more sources using ohm's law?

Now the teacher consolidates the limitation of ohm’s law and introduces Kirchoff”s laws and explains KCL and KVL.

Now a typical simple problem is given to students to discussion in groups and arrive at solutions using KVL.

Consolidation

Teacher consolidates the relevance of KCL and KVL and the methods how to solve problems using those laws.

Work sheets

1. Complete the following table

<table>
<thead>
<tr>
<th>$\theta = \omega t$</th>
<th>$V = V_o \sin \omega t$</th>
<th>$I = I_o \sin \omega t$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0$</td>
<td>..................</td>
<td>..................</td>
</tr>
<tr>
<td>$\frac{\pi}{2}$</td>
<td>$V_o$</td>
<td>..................</td>
</tr>
<tr>
<td>$\pi$</td>
<td>..................</td>
<td>..................</td>
</tr>
<tr>
<td>$\frac{3\pi}{2}$</td>
<td>..................</td>
<td>$-I_o$</td>
</tr>
<tr>
<td>$2\pi$</td>
<td>$0$</td>
<td>..................</td>
</tr>
</tbody>
</table>

2. Make a table showing comparison between AC and DC voltages.
T.E. Questions

I
(1) Select a non-ohmic conductor from the following
   a. Copper         b. Gold          c. Silicon         d. Aluminium

(2) Ohm’s law is not valid for all materials. Do you agree with this? Explain?

II.
(1) If ‘n’ resistors each of value ‘R’ ohms are first connected in series of then in parallel the ratio of their effective resistance will be
   a. \(\frac{n}{2}\)         b. \(n^2\)          c. 2n          d. \(2^n\)

(2) When a number of resistors are connected in parallel, the effective resistance will be less than the least. Comment on the statement with proof.

(3) A number of resistors each of value RΩ are first connected in series and then, in parallel. Get their effective values in each case.

III. If two capacitors each of value 100μF are connected in series the effective capacitance will be
   a. 500μF         b. 200μF          c. 20μF          d. 2μF

IV. In a real voltage source the internal resistance is shown ........ with the ideal voltage source and in a real current source the internal resistance is shown .......... with the ideal current source.

V.
(1) rms and average values of AC voltages are
   a. \(\frac{V_m}{\sqrt{2}} \cdot \frac{2V_m}{\pi}\)         b. \(\frac{V_m}{\sqrt{2}} \cdot \frac{V_m}{\pi}\)          c. \(\frac{2V_m}{\sqrt{2}} \cdot \frac{V_m}{\pi}\)          d. \(\frac{V_m}{\pi} \cdot \frac{V_m}{\sqrt{2}}\)

(2) If an AC voltage is represented by \(V = 300 \sin 628t\), the rms value of voltage and frequency are respectively.
   a. 300 V, 314 Hz         b. \(\frac{300}{\sqrt{2}} \cdot 100\)Hz          c. \(\frac{300}{\sqrt{2}} \cdot 628\)Hz          d. 300 V, 100 Hz
VI.

(1) In a purely capacitive AC circuit,
   a. Voltage leads the current through the capacitor by $\frac{\pi}{2}$ radians.
   b. Voltage lags current by $\frac{\pi}{2}$ radians
   c. Voltage leads the current by $\pi$ radians
   d. Voltage lags current by $\pi$ radians

(2) In RLC series AC circuit, at resonance
   a. $Z = X_L - X_C$  
   b. $X_L > X_C$  
   c. $X_L < X_C$  
   d. $Z = R$

(3) For an AC circuit with inductive load only the current lags behind voltage by $\frac{\pi}{2}$ radians. Do you agree with this? Justify the statement with necessary diagrams.

VII.

(1) As the value of capacitance of a capacitor increases by two times, it reactance.
   a. doubles 
   b. halves 
   c. increased by 4 times 
   d. Decreases to $\frac{1}{4}$ of the value

(2) For an RLC series circuit what is the condition that the circuit becomes purely resistive? Explain.

VIII. For solving complicated networks Kirchoff’s laws can be used. Explain with necessary diagrams.

IX. House hold AC supply is specified as 230 V 50 Hz. Which value of AC voltage is mentioned here? RMS, Average or Maximum value? Comment on the relation between the above said values.

P.E. Items

1. A circuit diagram as follows may be given to students and they may be requested to assemble the circuit and verify ohm’s law using it.

![Circuit Diagram](image)
2. Using 230/6-0-6 V transformer the learner may be requested to reduce the AC voltage and measure its maximum value using CRO, calculate its rms value and verify the obtained value with the actual value of voltage from the transformer secondary.

**Reference**

1. A textbook of Electrical Technology (vol. 1) - B.L. Theraja and A.K. Theraja

**ICT**