UpaStapana INSTITUTE

RRB TECHNICIAN Grade - I - Signal

RAILWAY RECRUITMENT BOARD

BASIC SCIENCE AND ENGINEERING

This Book has been prepared according to the syllabus of "RRB GRADE 1 SIGNAL"

SYLLABUS FOR BASIC SCIENCE AND ENGINEERING

1. ELECTRICITY AND MAGNETISM
2. ELECTRONICS
3. MEASUREMENTS
4. PHYSICS FUNDAMENTALS

We have provided content of each topic and 1000+mcqs also solutions to each question

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UpaStapana

Competitive Institute

RRB grade – I (Signal),
Basic Science & Engineering (B.S.E)

As per qualification details mentioned in RRB Grade – I (Signal) Notification.

Subject is given with clear explanation, previous year's questions with solutions, subject wise and chapter wise of various Examinations which are related to the Basic Science & Engineering Syllabus only.

UpaStapana Institute.

"R.R.B. Grade – I (Signal)",

Basic Science & Engineering.

First Edition – 2024

Published by:

"UpaStapana Institute".

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MRP
Rs. **699**

PREFACE

As competitive exams aspirants Face stiff competition in this competitive world, a comprehensive book which covers concepts, PYQs, Model questions and clear explanation is essential to achieve the desired goal.

Keeping this need in mind, we are delighted to bring this book to you. This book is the result of our constant efforts to help aspirants reach their destination. Further, we emphasize that this book is suitable for **"RRB Technician Grade – I"** students for their technical exams.

This book has been written in a lucid manner keeping in mind the needs of aspirants.

For the benefit of aspirants, we have included the questions asked in previous years exams and also provided clear cut explanation to each question in a way which is understandable even to the average student.

We have also taken content and questions from various standard books.

Solving previous questions helps aspirants understand the level of difficulty in the exams and also familiarizes them with the kind of questions expected to be asked in the upcoming exams.

I am grateful to the staff of "**UpaStapana Institute"** for their continuous encouragement and immense support to write this book.

We strongly believe that this book is highly beneficial to you if you use it properly.

We hope we would become a part of your success.

ALL THE BEST.

Prepared by
Er. Muralidhar Jadi sir, M.tech EEE
Technical Faculty.

SYLLABUS FOR BASIC SCIENCE AND ENGINEERING

1. ELECTRICITY AND MAGNETISM

Electric Charge, Field, and Intensity, Electric Potential and Potential difference, Simple Electric Circuits, Conductors, Non-Conductors/Insulators, ohm's Law and its limitations, Resistances in series parallel of circuit and Resistance and Specific Resistance, Relation between Electric Potential, Energy, Conductors, Electromagnetic Induction, Faraday's Law and Electromagnetic Flux, Magnetic Field, Magnetic Induction.

2. ELECTRONICS

Basic Electronics, Digital Electronics, Electronic Devices and Circuits, Microcontrollers, Microprocessors, Measuring system and Principles, Range Extension Methods.

3. MEASUREMENTS

Electronic Measurements, Cathode Ray Oscilloscope, LCD, LED Panel, Transducers.

4. PHYSICS FUNDAMENTALS

Units, Measurements, Mass, Weight, Density, Work, Power and Energy, Speed and Velocity, Heat and Temperature.

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ELECTRICITY AND MAGNETISM

ELECTRONICS

MEASUREMENTS

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9. PHYSICS FUNDAMENTALS

BASIC ELECTRIC CIRCUITS

SYNOPSIS

DEFINITIONS:

1. **Electric Network: The** interconnection of two or more circuit elements called as electric network.
2. **Electric Circuit: The** interconnection of two or more circuit element with at least one closed path is called as electric circuit.
3. **Circuit Element: Circuit** element refers to the mathematical model of a physical device.
4. **Types of circuit elements:** There are mainly two types of circuit elements.
   1. General circuit elements
   2. Simple circuit elements

General Circuit Elements:

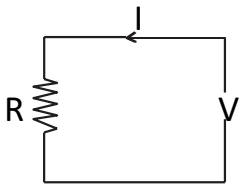
A general circuit element may be composed of more than one simple circuit elements.

Ex: Transformer

Simple Circuit Elements:

A simple circuit element is the mathematical model of a two terminal devices.

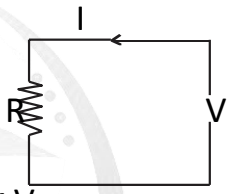
Ex: Resistor, Inductor.



Types of Simple Circuit Elements

All the simple circuit elements can be classified according to the relationship of the current through the element, to the voltage across the element.

Resistor: if the voltage across the element is directly proportional to the current through it, then the element is a resistor.



$I \propto V$

$V \propto I$

$V=IR$

Where R is the resistance in ohms.

Characteristics of Resistor

1. **Ohm's Law:** Temperature remaining constant, the current passing through the conductor is directly proportional to the potential difference applied across the ends of the conductor, Mathematically

   $I \propto V$

   $V \propto I$

   $V=IR$

   Where the constant of proportionality R is called as the resistance in ohms.

   $$1\Omega = \frac{IV}{A}$$

2. **Power :** The power absorbed by a

resistor is given by

$P = VI = I R = \frac{V^2}{R}$ watts

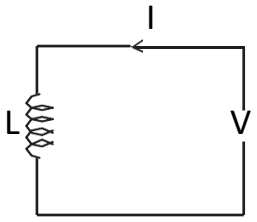
3. **Conductance: The** reciprocal of resistance is called as conductance. The unit for conductance is mho (℧).
4. **Open Circuit and Short Circuit:**
5. Resistance may be used as basis for defining the terms short circuit and open circuit.
   a. **Properties of Open Circuit:**
      1. Resistance is infinite R=∞Ω
      2. Current must be zero I=0 A
      3. Voltage across open circuit may have any value.
   b. **Properties of short circuit:**
      1. Resistance is zero R= 0 Ω
      2. Voltage across short circuit must be zero V= 0 volts
      3. Current may have any value.

Inductor (L):

If terminal voltage is proportional to the time derivative of current through then that element is an inductor.

$V \propto \frac{di}{dt}$ $V = L\frac{di}{dt}$

Where L is inductance is Henries.



$1H = 1\frac{V-S}{A}$

a. **Characteristics of Inductor:**

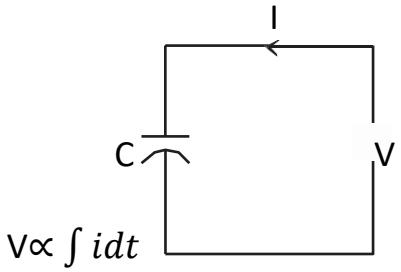
1. There is no voltage across an inductor if the current through it is not changing with time i.e., an inductor acts as a short circuit to D.C. under steady state.

   $V = L\frac{di}{dt}$
2. A finite amount of energy can be stored in an inductor even if the voltage across inductance is zero, such as, when a current is d.c.

   i.e, $E = \frac{1}{2} CV^2$ joules
3. It is impossible to change the current through an inductor by a finite amount in zero time. For this, it requires infinite voltage across it i.e., an inductor resists
4. An inductor stores energy in magnetic form and is given by $E(f) = \frac{1}{2} L(I)^2$
5. The average power absorbed by it is zero.

Capacitor:

If the terminal voltage is proportional to the integral of current through it then that element is a capacitor.



$V \propto \int idt$

$V=\frac{1}{2}\int idt$

Where C is capacitance in Farads.

1. Characteristics of Capacitor:

a. The current through capacitor is zero, if the voltage across it is not changing with time .i.e., a capacitor acts as an open circuit to D.C. under steady state.

$$\therefore I = C\frac{dv}{dt}$$

b. A finite amount of energy can be stored in a capacitor, even if the current through the capacitor is zero.

i.e., $E=\frac{1}{2}CV^2$, Joules

c. It is impossible to change the voltage across a capacitor by a finite amount in zero time, for this, it require an infinite current through the capacitor i.e., a capacitor resists abrupt change in voltage across it.

change in current through it.

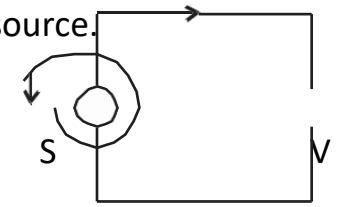
d. The capacitor stores energy in an electric field and given by

$E(t)=\frac{1}{2}CV^2(t)$, Joules

e. The average power absorbed by it is zero.

2. Independent Voltage source:

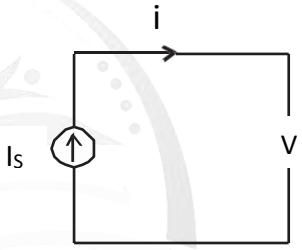
If the terminal voltage across the element is completely independent of current flowing through it, then that element is independent voltage source.



V is independent of current I

3. Independent current source:

If the current passing through the element Is completely independent of terminal voltage across it then that element is an independent current source.

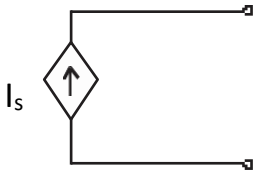


I is independent of voltage V

4. Dependent Sources:

The source quantity is determined by a voltage or a current existing at some other location in the electrical system under examination.

Dependent voltage Source



WORK POWER & ENERGY:

1. The amount of energy required to maintain a current of I through a resistance of R for t seconds is