

sources. The mathematical models of voltage and current sources are explained and subsequently the basic principles of voltage and current dividers are discussed. Each topic of this lesson is clearly illustrated by solving some numerical problems.

## **2.2 Loop Analysis of resistive circuit in the context of dc voltages and currents**

In this lesson, loop analysis method based on Ohms law and Kirchoffs voltage law is presented to obtain a solution of a resistive network. This technique is particularly effective when applied to circuits containing voltage sources exclusively; however, it may be applied to circuits containing both voltage and current sources. Several numerical problems including both voltage and current sources have been considered to illustrate the steps involved in loop analysis method.

## **2.3 Node-voltage analysis of resistive circuit in the context of dc voltages and currents**

Node voltage analysis is the most general and powerful method based on Kirchhoff's current law is introduced in this lesson for the analysis of electric circuits. The choice of one of the nodes as reference node for the analysis of dc circuit is discussed. The procedure for analyzing a dc network is demonstrated by solving some resistive circuit problems.

## **2.4 Wye (Y) – Delta ( $\Delta$ ) or Delta ( $\Delta$ ) – Wye (Y) Transformations**

The objective of this lesson is to introduce how to convert a three terminal Delta ( $\Delta$ ) / Wye (Y) network into an equivalent Wye (Y) / Delta ( $\Delta$ ) through transformations. These are all useful techniques for determining the voltage and current levels in a complex circuit. Some typical problems are solved to familiarize with these transformations.

## **2.5 Superposition Theorem in the context of dc voltage and current sources acting in a resistive network**

This lesson discusses a concept that is frequently called upon in the analysis of linear circuits (See 2.3). The principle of superposition is primarily a conceptual aid that can be very useful tool in simplifying the solution of circuits containing multiple independent voltage and current sources. It is usually not an efficient method. Concept of superposition theorem is illustrated by solving few circuit problems.

## **2.6 Thevenin's and Norton's theorems in the context of dc voltage and current sources in a resistive network**

In this lesson we consider a pair of equivalent circuits, called Thevenin's and Norton's forms, containing both resistors and sources at the heart of circuit analysis. These theorems are discussed at length and highlighted their great utility in simplifying many practical circuit problems.

Reduction of linear circuits to either equivalent form is explained through solution of some circuit problems. Subsequently, the maximum power transfer to the load from the rest of circuit is also considered in this lesson using the concept of these theorems.

term, 'power factor' in this respect. The concept of apparent and reactive power (with its sign for lagging and leading load) is presented, along with formula.

## Module-5 Three phase AC circuits

There are only three lessons (5.1-5.3) in this module. Only the balanced star-and delta-connected circuits fed from three-phase ac supply are presented here.

### 5.1 Generation of three-phase voltage, line and phase quantities in star- and delta-connection and their relations

The generation of three-phase balanced voltages is initially presented. The balanced windings as described can be connected in star- and delta-configuration. The relation between line and phase voltages for star-connected supply is presented. Also described is the relation between phase and line currents, when the windings are connected in delta. The phasor diagrams are drawn for all cases.

### 5.2 Solution of three-phase balanced circuits

The load (balanced) is connected in star to a balanced three-phase ac supply. The currents in all three phases are determined, with phasor diagram drawn showing all voltages and currents. Then, the relation between phase and line currents is derived for balanced delta-connected load. The power (active) consumed in the balanced load is derived in terms of the line voltage and currents for both cases.

### 5.3 Measurement of three phase power

The total power (in all three phases) is measured using two wattmeters only. This is shown for both unbalanced and balanced cases. The phasor diagram with balanced three-phase load is drawn. Other cases are also described.

## Module-6 Magnetic circuits & Core losses

In this module there are two Lessons 21 and 22 as enumerated below.

### 6.1 Simple magnetic circuits

It is often necessary to produce a desired magnetic flux, in a magnetic material (core) having a definite geometric shape with or without air gap, with the help of current passing through a coil wrapped around the core. This lesson discusses how the concept of circuit analogy can be introduced to tackle such problems. Both linear and non-linear magnetic circuit problems are discussed through worked out problems.

### 6.2 Eddy current & hysteresis losses

These two losses are produced in any magnetic material which is subjected to an alternating time varying fields. Generally in all types of A.C machines /equipments working on electromagnetic principle these losses occur. In D.C machine armature too these losses occur. In this lesson the origin of these losses are explained and formula for estimating them are derived. Finally methods adopted to minimize these losses discussed as losses bring down the efficiency of any machines.