
Introduction to Electronic Theory

Course No. 103 (formerly 104-2)

Course Outline

FOR WHOM INTENDED This course is intended for individuals whose primary formal training is not in the field of electronic engineering. Electrical controls and electronics are incorporated in almost every technical activity, and all technical personnel have to deal with some aspects of electronics. A basic understanding of electronics is essential to better perform their main function.

OBJECTIVES To help participants to understand the concepts and terminology of electronics. It is not an in-depth electronics course but rather a course aimed at individuals who require an intensive review of basic principals, without the assumption of any prior knowledge of the topic. The course is fast paced and as non-mathematical as possible.

BRIEF COURSE DESCRIPTION The course begins with the concept of an electrical circuit, with an example. A brief review of related mathematics follows, including vectors, phasors, RMS and scientific and engineering notation. The course covers basic concepts of electrical theory, starting with the simple DC circuit and Ohm's Law. Sinusoidal and non-sinusoidal waveforms are discussed as they apply to electrical technology.

The course then describes the basic components encountered in electrical circuits, such as resistors, capacitors, inductors etc. The course discusses behavior of inductors and gives examples of circuit theory, including LCR circuits and filters, also transient RL circuit analysis. Resonant circuits and their applications are covered. The basic theory of transformers and their various types: power, current, potential and transformers used in measurement systems are discussed, as are rectifier and filter circuits.

Moving from electricity to basic electronics, we cover the theory of solid-state electronics, including semiconductor physics, diodes and transistors. The course presents amplifiers, including various applications of power amplifiers, negative feedback etc. This leads to the study of oscillators and digital logic circuits.

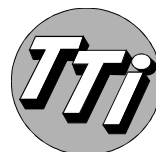
RELATED COURSES This course is related to TTI's courses 104 and 104/105, which form part of TTI's [Dynamic Test Specialist \(DTS\)](#), [Electronic Telecommunications Specialist \(ETS\)](#), [Mechanical Design Specialist \(MDS\)](#) and [Instrumentation Test Specialist \(ITS\)](#) Diploma Programs. Course 103 may be used as an *optional course* for any TTI Specialist Diploma Program for which course 104 is not required. Any TTI course may be presented at your facility.

PREREQUISITES An understanding of basic algebra will be useful. This course is meant for individuals working in a technical field other than electronics.

TEXT Each student will receive 180 days access to the on-line electronic course workbook. Renewals and printed textbooks are available for an additional fee.

COURSE HOURS, CERTIFICATE AND CEUs On-site courses can vary from 14–35 hours over 2–5 days as requested by our clients. Upon successful course completion, each participant receives a certificate of completion and one Continuing Education Unit (CEU) for every ten class hours.

Introduction: Review of a typical electronic circuit
Schematic of a Radio Receiver • Electronic Symbols and Abbreviations
Path of Signals through Circuit • Block Diagram
Mathematical Fundamentals • Scientific and Engineering Notation
Radians • Vectors • Angular Frequency • Phase • Complex Algebra
Electrical Fundamentals Review: Electrostatic Field and Potentials
Charge • Conductors, Insulators • Current, Voltage • Ohm's Law
EMFs in Series and Parallel • Resistors • Series Circuits
Network Laws: Kirchhoff's Laws • Thevenin's and Norton's Theorems
Alternating Current • Sine and Non-sine Waveforms • Square Wave
Pulse Shape of Square Wave • Complex Waveform • Harmonics
Digital vs. Analog Waveforms • Unwanted Digital Signals
Examples: Parallel Circuits • Conductance • DC Series-Parallel circuits
Thevenin's Theorem • Effective or rms Value of Current or power
Addition of Sine Waves
Capacitors and Inductors: Capacitors in DC circuits • Capacitance
Capacitors in Parallel and in Series • Inductance • Mutual Inductance
Inductors in Series and Parallel
Transient RC and RL Circuits: RC and RL Time Constants
Examples: RC Time Constant • RL Time Constant
Current Fall in an Inductor • Change in Voltage
Reactance, Impedance in AC Circuits: Capacitive, Inductive Reactance
Impedance Triangle • Impedances of a Reactive AC Circuit
Inductive and Capacitive Reactance in an AC Circuit
Reactance in Series AC Circuits: RL, RC, RLC
Impedances in Series or Parallel • Parallel Reactance • Examples
Series and Parallel Resonance: Resonant Frequency
Q of a Series Circuit • Bandwidth of Series R-L-C Circuit • Example
Parallel Resonance • Band-pass and Band-stop Filters
Transformers: Equivalent Circuit • Turns Ratio
Power Relationships, Efficiency • Impedance Matching
Transformers: Loosely coupled, Single and Double Tuned
Local Power Distribution Systems • Voltage Transformations
Rectifiers and Filters: Power Supply with Regulator
Half and Full Wave Rectification • Bridge Rectifier • Filters
Capacitive Load • Power Supply Loading • Filter Choke
Semiconductor Physics: N-type and P-type Doping • Diffusion
Diodes, Transistors and Biasing: Alloy Junction Diode
Planar Technology (Diffusing) • P-N Junction Behavior • Junction Barrier
Transistors and Biasing • How transistors amplify • NPN Transistor
Amplifier Gain • Common Base, Emitter, Collector Circuits
Amplifier Fundamentals and Considerations: How Transistors Amplify
Transistor voltage, Power Gain and Operating Point
Base Bias Adjustment • Signal Clipping • Classes of Operation
Coupling Methods • Frequency Response • Distortion • Slewing Rate
Tuned Amplifiers, Oscillators and Feedback: AM and FM IF Bandwidths
IF Amplifier Stage • Detector and AGC Circuit • Oscillators
Kinds of Oscillators • RC Oscillators • Feedback • Negative Feedback
Differential and Operational Amplifiers: One Input • Two Inputs
Common Mode Rejection • Op Amp characteristics
Mini-DIP Integrated Circuit • Rules for External Feedback Op Amps
Op Amp Circuits: Inverting or Noninverting Amplifier • Follower
Basic Cautions • Applications
Digital Logic Functions: Logic Gates
Inverter, AND, OR, NAND, NOR, XNOR, XOR
Summary, Discussion • Final quiz
Award of Certificates for Successful Completion



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