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DESIGN AND CONSTRUCTION OF AN ELECTRONIC CIRCUIT TRAINING APPARATUS

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Abstract
The electronic circuit training apparatus is a completely self-contained laboratory instrument that consists mainly of a functional generator unit to produce sine and square waveforms with frequencies ranging from 1KHz to 15KHz and 0V to 12V of amplitude, fixed power supplies of +6V, +12V and -12V, a variable power supply unit with voltage ranging from ±1.2V to ±30.2V, a potentiometer, operational amplifier and a series of different values of discrete components like capacitors, resistors and diodes all on a single printed circuit board. It creates an avenue for practical exposure for students of electronics to be more creative and productive in the design and construction of electronic circuits. Test results indicate that the apparatus is an indispensable equipment in electronic laboratories.

Key Words: Electronic components, electronic design, test running.

Introduction

The fundamental problems encountered by students of electronics ranges from that of non availability of components, high cost of components and the phobia of attempting to design and construct. The training apparatus solves all these, being a get together of very important conventional electronic components and mini equipment needed for today's practice, it thus takes away complain of non availability, high cost, risk of fake and low quality components. Also, it provides a platform for test running designs which encourage and stimulate students' technological minds towards innovation.

Methodology

The design consideration for the apparatus is sub divided into units as analyzed below.

Power Supply Unit: This is the unit capable of supplying a direct voltage and current to the electronic circuit under test (Grobs and Mitchel, 2003). It converts the Alternating Current (AC) at the mains into

Direct Current (DC) of desired specification needed by a user. The conversion of AC to DC was achieved via a 240V/60V centre tapped step down transformer and a full wave rectifier employing four IN4002 diodes. The DC output of the rectifier is given as;

$$V_{out} = 0.71V_s \qquad (1)$$

Where V_s is the voltage at the secondary coil of the transformer which is 60V. Equation (1) yields 42.6V. The power supply unit of this design is categorized into two, they are;

1. The fixed power supply of +12V, -12V and +6V achieved with the aid of IC regulators 7812, 7912 and 7806 respectively. C_1, C_2, C_3, C_4, C_7, C_8, C_{10} and C_{11} are 270nF capacitors, while C_5, C_6 and C_9 are 10μF capacitors. All are filter capacitors to convert the full-wave output of the rectifier into a smooth DC output voltage. D_1, D_2 and D_3 are all IN4001 protection diode to maintain polarity of the output voltage.
2. The variable power supply of 1.2V to 31.2V and -1.2V to -31.2V achieved with the aid of variable regulators 317K and 338K and variable resistors Rv_1 and Rv_2. Figure 1. is the complete circuit diagram of the power unit.