HIGHER TECHNICAL INSTITUTE
ELECTRICAL ENGINEERING DEPARTMENT

DIPLOMA PROJECT

STUDY OF THE DESIGN OF OPERATIONAL AMPLIFIER CIRCUIT

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BY

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Loukianos Raftis

To God and my family

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SUMMARY

The main purpose of this project is to examine the basic characteristics of op-amp and especially *A741* and to examine some electronic circuits which for some reasons there are not any information about them in books or other electronics sources.
This circuits are: **1.** ***Inverting Amplifier***
2. ***Step Wise generator - Passive***
3. ***Step Wise generator - Active***

The inverting amplifier is used only for some important tests and to derive waveforms regarding op-amps.
The other two circuit are based on the following examinable series :
(1) *Operation:* examine the way that the circuit works in theory giving also specific diagrams.
(2) *Mathematical Analysis* : examine in theory what results must be got by applying specific formulas for each one circuit.
(3) *Experimental Results:* by taking the corresponding measurements for each one circuit, waveforms and other observations are extracted.
(4) *Conclusions:* compare the result that was found before (theoretical-experimental) and give also emphasis to important points.

INTRODUCTION

Electronics is the backbone of electrical engineering. Whether we specialize in solid state electronic design,or in diverse areas such as power, computers, controls, or communications we must first become familiar with the basics of the design and analysis of electronic circuits and systems.

The striking advances in electronics during recent year have been due to the development of semiconductor devices such as junction diodes, transistor and integrated circuits (IC's).
Because of their small size, low power requirements and very long life they have largely replaced thermionic valves in modern electronic equipment.

The operational amplifier (op-amp) was designed originally to solve complex mathematical equations electronically by performing operations such as addition, subtraction and integration. They are produced in integrated circuit form and one of the main present day uses is for high gain AC and DC voltage amplification. More information's will be given in the following topic.

It is also important to mention the chief properties of the op-amp which are:
(1) *A very high voltage gain:* called the open loop gain Ao, which means typically is 10^5 for DC and low frequencies but decreases with the increase of frequency.
(2) *A very high input resistance:* typically 10^12, it therefore draws a minute current from device or circuit supplying its input, and
(3) *A very low output resistance:* typically 100Ω which means that its output voltage can be transferred with little loss to a load greater than few KΩs.
(4) *Bandwidth* : The gain bandwith product is fixed at approximately 1MHz which results from the frequency response curves.

One of the popular op-amps, which is used for this project, is the ***A741*** .It has been produced since 1966 by most manufacturers, and although there have been many advances since its introduction, the *A741* is still widely used.
The *A741* op-amp has internal compensation, which refers to the RC network that causes the amplitude response to fall off at higher frequencies.