**ENA PROJECT**

**Final Report**

**(DC Variable Power Supply )**

**Group members:**

* Hafiz Ahsan Sheraz
* Danyal Irfan Butt

**Abstract:**

Our project is a variable DC power supply which converts the main AC power supplied by WAPDA into DC. We know that Ac power thanks to WAPDA is available almost everywhere but Dc power, due to transmission limitations can be provided everywhere. Almost all electronic devices operate on the Dc supply. So, our solution to this problem is to directly convert the easily available AC power supply to DC by using the electrical engineering techniques.

**Introduction :**

Variable DC power supply is a simple circuit device that takes the AC power directly from the main power line, Steps it down to a certain voltage using step-down transformer and then then converts it to pulsating full bridge rectifier. Then this pulsating DC voltage is smoothed by a capacitive filter and fed into the buck-converter module. The buck-converter module uses IC called **Lm2596** ,which steps down the fed voltage to a certain value depending upon the user requirement. The minimum voltage that can be set is **1.23V** and maximum is approximately equal to the input voltage i.e: maximum 40V. The output voltage is then filtered by LC filter to remove fluctuations.

**Applications :**

* Testing of electronic devices .
* To charge rechargeable batteries of different voltages .
* For electroplating process in industries .
* In power industry for running synchronous generator .

**Literature Review:**

Ever since the fight between the Tesla and Edison on whether AC or DC supply is more efficient, which was won by tesla i.e: AC power; the production of Dc supply by the Power companies is almost negligible because of the inefficiency of the process. Despite the truth DC supply has its own value in various fields electrical engineers came up with the techniques to effectively convert the easily available AC supply into desired Dc supply. Our work is also a based on these techniques.

**Hardware Used:**

* Step down transformer ( 220 V to 12 V AC )
* Full wave rectifier
* LM-2596 DC to DC buck converter module
* 1000 microfarad capacitor (filtering capacitor
* Digital voltmeter (to display the changing voltage)
* 10 K potentiometer (to vary the voltage)

**Making/Design:**

The step-down transformer is connected to 220 V AC outlet . On the output full bridge rectifier is attached . Then it is attached with capacitor(filter), and this is attached with the buck converter . Potentiometer is attached with the buck converter . Digital voltmeter is attached at the output for display . The circuit is shown above:

**Proteous Simulation of Variable DC supply**

**A picture containing text, shoji

Description automatically generatedCalculations/Formulas:**

* The cut off frequency for LC low pass filter =
* The capacitors voltage rating should be at least 1.5 times greater than the output voltage, and often much higher voltage rating is needed to satisfy low ESR requirement. So a capacitor in the range of **220uF to 1500uF** can be used.
* The filter capacitor at the input should be optimal for depressing the transient effects but not too large that would damage the module as it discharges on the shutdown of device so a capacitor in range of **100uF to 1200uF** can be used for filtering out the transient response.
* V(ref) = 1.23 V
* R1 = 1k ohm
* R2 is the resistance of the potentiometer so for every resistance of the potentiometer. The optimal potentiometer should have a range of **0-10 kΩ.**
* The maximum current supplied by the buck converter is 3A .
* The expression for output voltage is:

Text, letter

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* For the selection of diode:

Text

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* The ripple factor of the capacitor filter at the input is given by:

Text

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* The cut off frequency of capacitive low pass fiter:

Graphical user interface, text, application

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**Working:**

When 220 V AC is given to the transformer , it uses the concept of mutual induction between two coils to step the voltage down to 12 V AC . As the output of transformer is 12V AC , a rectifier is attached to convert the 12 V AC to 12 V DC . But even after attaching the rectifier , the output is 12 V pulsating voltage , so to convert the pulsating voltage to approximately smooth voltage a capacitor is attached . The capacitor is placed such that when the pulsating voltage reaches its maximum value , the capacitor gets fully charged or enough charged and when the pulsating voltage starts

decreasing , the capacitor releases its current, so the voltage doesn’t go down , so we get Dc in the form of ripples .

Diagram

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Diagram

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**Buck Converter module**

Next , the DC voltage goes to the buck converter . It is LM-2596 DC to DC buck converter . It works by taking in DC input voltage and steps down to approximately 1.23 volts . So, 1.23 volts is the minimum voltage than can be obtained . A 10K potentiometer is attached , so by moving the 10k potentiometer the voltage varies from 1.25 to the maximum voltage at output which in this case is 12V, so a voltage range is from 1.25 to 12 volts DC . The buck converter module which steps down DC voltage and creates a voltage range which can be assessed by potentiometer is shown :

**Simulation Results:**

Chart

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Chart, scatter chart

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Chart, scatter chart

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**Conclusion:** This project is effective as it makes our life easier by supplying DC voltage according to our requirement . It supplies maximum current of 3A and voltage ranging from 1.23 to approximately 12 volts . It uses mutual induction , rectification , filtering , DC to DC conversion to provide a specific voltage range .