Dc regulated power supply project report

DC Variable Power Supply Circuit Design Report Submitted in partial compliance with the requirement to hold a master's degree in physics. Submitted to: DR. MITHLESH KUMARI Head Department of Physics Kanahiya Lal D.A.V. (P.G.) College, Roorkee- 247667 Associated with Hemwati Nandan Bahuguna Garhwal University, Srinagar (Central University) Presented by: NAMAN SAINI M.Sc. (Phy.) Sem-III R. No. 18316343015 Under the direction of: DR. VANDITA SRIVASTAVA Assistant Professor of Physics Session: 2019-20 RECOGNITION First we express our warmest thanks and gratitude to Almighty God for his divine blessing allows us to successfully complete this project. We have fallen grateful and wish our deep debt to our superior Dr. Vandita Srivastava, assistant professor, department of physics. Deep knowledge & interest of our supervisor worked as an influencer for the implementation of the project. Her endless patience, guidance, constant encouragement, constant and vigorous supervision, constructive criticism and valuable advice made it possible to complete this project. We would like to express our deepest gratitude to Prof. (Dr.) Mithlesh Kumari, Head of Physics, for your motivation and valuable suggestions from time to time. I would like to express my heartfelt thanks to my mentor and project guide Mrs. Renuka Verma, Faculty (Physics), who has given valuable help, expert guidance and healthy suggestions for completing this project work. I am also grateful to the other faculty members and staff of the physics department of our college. I would like to thank my friends & course-mate who took part in this project and helped me a lot during the completion of the project. Finally, I express my sincere respect for my parents, whose blessings have always been a constant source of inspiration to engage in higher aspirations. NAMAN SAINI ANIVESH SHARAMA RISHABH GUPTA ABSTRACT Here we make a variable DC power supply, and the main principle of operation of this project is full wave repair, which is carried out using the bridge configuration. Where we use 4 LEDs and these correct the step-down transformer output that step down 220 V AC to 24 V AC. In this circuit we use two capacitors, C1 and C2 are used to obtain a constant input to the regulator. In addition, it also helps to reduce sharp peaks in the output. 2200 μF and 470 μF capacitors are used to reduce noise and waves produced by regulators. So that the adjustable output has fewer wrinkles. Here we also use a voltage regulator that gives a constant voltage, which gives 6 V and it is an IC LM317 voltage regulator. Now the main task is to obtain a variable output power and for this we use a pair of resistors voltage splitters Variable resistor 1kΩ & 10kΩ to increase the output of the regulator and in which the resistance is variable. So, when we increase or decrease the value of this resistor, the output voltage of the regulator will also change and we will get a range of 2V to variable voltage. CONTENT Target Required material Theory & operating principle about Transformer block description o Rectifier o Filter for Voltage Regulation Circuit Diagram Calculation Production Process Results OBJECTIVE 1 References. To design a circuit for alternating DC power supply that ranges from 2v to 15v & 2A current using IC LM317. 2. To observe the output to meet the requirements. REQUIRED MATERIAL [A] Components 1. Transformer 240v 50 HZ (24v-2A) 2. 4 LEDs 1N4001 & 2 LED 1N4007 3. Capacitor 2200μF/50v 4. Capacitor 470μF/50v 5. capacitor 0.1μF (104) 6. 10μF/63V 7. LM317T IC 8. Variable resistor 1kΩ & 10kΩ 9. 2.2KΩ/1W 10 resistor. 1 KΩ , 12 KΩ, 220 Ω resistor [B] Apparatus 1. Power supply 2. Multimeter 3. PCB 4. Connection cables 5. Wire beheading 6. SolderING THEORY & WORK Transformer: - Transformer + Rectifier: - Transformer + Rectifier + Smoothing: - Smooth DC output has a low ripple. Transformer + Rectifier + Smoothing + Regulator: - Adjustable DC output is very smooth without ripple. Suitable for all electronic circuits. Transformer A Transformer is a device used to raise or lower the AC supply voltage with appropriate current drop and increase. Basically it consists of two primary and secondary windings N1: no. coils in the primary coil N2: no. coils in secondary coil N1< N2 :- Step-up transformer N1> N2 :- Step-down transformers convert AC electricity from one voltage to another with a slight loss of power. Transformers only work with AC and this is one of the reasons why electricity from the grid is AC. Step-up transformers increase voltage, step-down transformers reduce voltage. Most power supplies use a step-down transformer to reduce dangerously high mains voltage (230v) to safer low voltage. Transformers and their input coil symbol is called the primary coil, and the output coil is called the auxiliary coil. There is no electrical connection between the two coils, instead they are connected by an alternating magnetic field formed in the soft core of the transformer. The two lines in the center of the perimeter symbol represent the core. Transformers waste very little power, so the power supply is (almost) equal to power. Please note that as the voltage accelerates, the current is increased. The ratio of the number of revolutions on each coe, called the coefficient of rotation, determines the voltage ratio. The step-down transformer has a large number of revolutions on its primary (input) cone, which is connected to the power supply of the high-voltage mains, and a small number of revolutions on the secondary (output) cod to ensure low output voltage. Rectifier There are several ways to connect leDs to make a rectifier to convert AC to DC. The bridge rectifier is the most important and produces full-wave DC ac current. The full-wave rectifier can be made of just two LEDs if you are using a transformer centrally, but this method is rarely used now when the LEDs are cheaper. A single LED can used as a rectifier, but uses only positive (+) AC wave parts to produce semi-wave DC differences. Bridge Rectifier Bridge Rectifier can be made using four individual LEDs, but it is also available in special packages containing the four required LEDs. It is called a full-wave rectifier because it uses the entire AC wave (both positive and negative sections). Vp = primary voltage (input) Np = number of revolutions of the primary coil Ip = primary current (input) Vs = secondary voltage (output) Ns = number of revolutions on the secondary coil Is = secondary current (output) Full wave bridge rectifier operation:- Positive halfcycle. During a positive power halfcycle, the D1 and D2 LEDs run in series, while the D3 and D4 LEDs are the opposite and the current flows through the load, as shown below. Negative half-cycle During the negative shelf cycle, the D3 and D4 LEDs run in series, but the D1 and D2 LEDs turn off because they are now inverted. The current flowing through the load is in the same direction as before. Fig. Smoothing (filter): - Smoothing is carried out by means of a high-value electrolytic capacitor connected by the DC power supply to act as a tank, supplying current to the output when the DC voltage changes from the rectifier falls. The diagram shows inseparable dc (dashed line) and smoothED DC (solid line). The capacitor charges quickly near the peak of ac current and then discharges when it supplies electricity to the output. Note: - Please note that smoothing significantly increases the average DC voltage to its peak (1.4 × RMS values). Smoothing is not ideal due to the drop in capacitor voltage as it discharges, which gives a low ripple voltage. For many circuits, a ripple of 10% of the supply voltage is satisfactory, and the following equation gives the required value for the smoothing capacitor. A larger capacitor will give you less ripple. Capacitor value must be doubled during DC semi-wave smoothing So we have come to the conclusion that pulsating DC voltage is applied to the smoothing capacitor. This smoothing capacitor reduces the pulsations of the dc output voltage of the rectifier. Smooth DC output has a low ripple. Suitable for most electronic circuits. Voltage regulation (using IC LM317) The output from the full wave bridge rectifier is fed to the LM317 IC LM317 controller provides a varied voltage from 1.2 V to 35V. The reference voltage of 1.25 V is maintained at a resistor of 220 ohm. The LM317 voltage regulator is a 3-end adjustable voltage regulator that can supply an output voltage adjustable from 1.2V to 35V. It can supply more than 1.5A load current to the load. LM317 Pinout LM317 voltage regulator has 3 pins. Below is the pinout: When viewed from the front of the voltage regulator, the first pin (left) is adjustable the middle is Vout and the last pin (right) is VIN. VIN - VIN is a pin that receives the incoming voltage to be adjusted to a specific voltage. For example, the input voltage pin can be given 12V, which the regulator regulates up to 10V. The input pin receives incoming, unregulated voltage. Adjustable - Adjustable pin (Adj) is a pin that allows for adjustable output voltage. To adjust the output, we replace the r2 resistor value with another resistance. This creates adjustable voltages. VOUT - VOUT is a pin that outputs the adjustable voltage. For example, the LM317 might get 12V as an input and a 10V fixed output as an output. Scheme LM317 Now that the pins, how can we modify the voltage to what we want to output? We do this by changing the value of the resistor connected to the Adj pin of the voltage regulator. Let's see that the diagram is set: Here we connect two resistors to the voltage regulator. These resistors determine the voltage that the voltage regulator regulates. Variable resistor (10 k Ω) resistor 220 Ω Voltage, which adjustable regulator outputs are determined by the following equation: Vout = Vref x {1+ (R/R4)} Vref = 1.25V R4 is 220Ω RV = 10KΩ (variable resistor) R RV x R2 / (RV + R2) Therefore, on the basis of this formula you can see that that the more the value of the Resistor R increases, the higher the output voltage. This is an advantage of adjustable voltage regulators. It can be adjusted to any voltage in the range that the voltage regulator supports. Capacitors C2 & C3 :- C2 capacitors (0.1 uF) and C3(10 uF) are used to clean the power line. C2 is optional and is used to clean the transient response. C3 is needed if the device is far from filter capacitors. These capacitors help smooth the power line in the event of sudden power spikes. C2-0.1uF (ceramic capacitor or mylar capacitor) reduces noise Capacitor 10uF C4 - 470uF 25V (electrolytic capacitors) acts as a miniature battery that provides energy during the spike. Capacitor 470uF DIODE D6 :- Diode D6 is used to prevent discharge of the 10uF capacitor to the adjustable IC. The D5 and D6 LEDs (both 1N4007) are protection from external voltage to the back to cause IC damage. If you put an incorrect D6 polarity, the VR10K will burn. PRODUCTION PROCESS Electrical manufacturing, consisting of electrical design i.e. PCB production, soldering, correct connection, etc. Various tools & equipment needed for the production of SOLDRING WIRE FLUX Soldring wire stream multimeter for wire cutting Soldering is a process in which two or more metal elements are connected together by melting and flowing metal filler into the connector, metal filler into the connector, metal filler with relatively low melting point. Soft soldering is characterized by a melting point of the filler metal, which is below 4000 C (7520F). The filler metal used in the process is In the soldering process, heat is applied to the parts to be combined by capillary action and bind to the materials to be combined by a wetting action. After the metal has cooled down, the resulting joints are not as strong as base metal, but they have the right strength. Tips & Soldiering Tricks is something you need to practice. These tips should help you start succeeding so you can stop practicing and get into some serious building. 1. Keep the iron tip clean. A clean iron tip means better heat conduction and a better connection. Use a wet sponge to clean the tip between the joints. 2. Double checkpoints. It is a good idea to check all the soldiers' joints with the Ohm meter after they have cooled down. If you common means more than a few tenths of an ohm, it might be a good idea to resolder it. 3. Use the appropriate iron. Remember that larger joints will take longer to heat up with a 30W iron than with a 150w. 4 iron. First, solder the small parts. Solder resistors, wire jumpers, DIODEs and other small parts before soldering larger parts such as capacitors and transistors. This makes installation much easier. RESULTS We get dc adjustable power supply, which may vary through a variable resistor from 1.2 V to 9V REFERENCES [1] Book Encyclopedia of Electronic Components by Charles Platt [2] Book Of Practical Electronics for Inventors Paul Scherz and Simon Monk [3] Book Circuit Theory and Analysis by Abhij [5] [6] [7] [8] [9] [10] [11]