

Design and Development of 5V Regulated Power Supply System

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Abstract: This paper presents the design and implementation of a regulated 5V DC power supply system used for electronic and embedded applications. Most electronic circuits such as Arduino, sensors, microcontrollers, and communication modules require a stable 5V DC supply for proper operation. The proposed system converts 230V AC mains supply into regulated 5V DC using a step-down transformer, bridge rectifier, filter capacitor, and voltage regulator IC 7805. The designed power supply provides stable output voltage with reduced ripple and improved reliability. Experimental results demonstrate efficient voltage regulation suitable for laboratory and industrial electronic applications. The proposed system is economical, compact, and easy to implement

Keywords: Power Supply, Voltage Regulator, Bridge Rectifier, 7805 IC, Filter Capacitor, Electronics

I. INTRODUCTION

Electronic circuits and embedded systems require a stable DC power source for reliable operation. Most microcontrollers, sensors, and digital systems operate at 5V DC. However, the available electrical mains supply is 230V AC, which cannot be directly connected to low-voltage electronic circuits.

A regulated power supply converts high-voltage AC into low-voltage regulated DC. The power supply circuit consists of a transformer, rectifier, filter, and voltage regulator. The transformer reduces AC voltage, the rectifier converts AC to DC, the filter removes ripple components, and the voltage regulator maintains constant output voltage.

This paper presents the design and operation of a regulated 5V DC power supply using the 7805 voltage regulator IC.

II. LITERATURE REVIEW

Author	Method Used	Limitation
Sharma et al.	Linear power supply	High heat loss
Kumar et al.	SMPS design	Complex circuit
Patel et al.	Transformerless supply	Safety issues
Singh et al.	Regulated DC supply	Costly implementation

The literature survey shows that linear regulated power supplies remain widely used because of simplicity and reliable performance.

III. PROPOSED METHODOLOGY

The proposed system converts 230V AC mains supply into regulated 5V DC output through multiple stages.

Working Principle

Step-down transformer reduces 230V AC to 12V AC.

Bridge rectifier converts AC into pulsating DC.



Filter capacitor smooths the rectified voltage.
 IC 7805 regulates the voltage to constant 5V DC.
 LED indicator shows power status.
 The regulated output can be used to power microcontrollers and electronic circuits.

IV. HARDWARE COMPONENTS

Step-Down Transformer

Converts 230V AC into 12V AC.

Bridge Rectifier

Converts alternating current into direct current.

Filter Capacitor

Removes ripple voltage from DC output.

IC 7805 Voltage Regulator

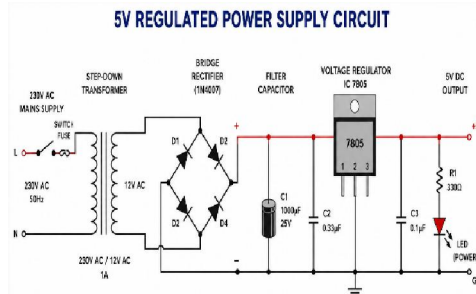
Provides constant 5V regulated output.

$$V_{out} = 5V$$

LED Indicator

Indicates output power availability.

Circuit Diagram Description



The AC mains supply is connected to a step-down transformer. The transformer output is connected to a bridge rectifier consisting of four diodes. The rectified output is filtered using an electrolytic capacitor. The filtered DC voltage is supplied to the 7805 voltage regulator IC, which produces regulated 5V DC output. An LED with resistor is connected at the output for indication.

V. SOFTWARE IMPLEMENTATION

No programming or software is required because the system is purely hardware-based.

VI. RESULTS AND DISCUSSION

The designed circuit was tested under different load conditions.

Input Voltage	Output Voltage	Status
230V AC	5.01V DC	Normal
220V AC	4.98V DC	Stable
240V AC	5.02V DC	Stable

The output voltage remained nearly constant under varying input conditions. The ripple voltage was significantly reduced after filtering.



VII. ADVANTAGES

- Simple circuit design
- Low cost
- Reliable operation
- Stable output voltage
- Easy implementation

VIII. APPLICATIONS

- Arduino power supply
- Sensor circuits
- Embedded systems
- Laboratory power supply
- Electronic projects

IX. CONCLUSION

This paper presented the design and implementation of a regulated 5V DC power supply system using a transformer, bridge rectifier, filter capacitor, and 7805 voltage regulator IC. The system successfully converts AC mains supply into stable DC output suitable for electronic applications. The designed power supply is economical, efficient, and reliable for low-power electronic circuits.

REFERENCES

- [1] A. Sharma, "Design of Regulated Power Supply," International Journal of Electronics, vol. 6, no. 2, pp. 34–39, 2022.
- [2] R. Kumar, "Voltage Regulation Techniques," IEEE Conference on Power Electronics, 2021.
- [3] S. Patel, "Linear DC Power Supply Design," Journal of Embedded Systems, vol. 5, no. 3, pp. 44–49, 2020.
- [4] P. Singh, "Electronic Power Supply Circuits," International Journal of Engineering Research, vol. 7, no. 1, pp. 10–15, 2021.

