Design, Analysis, and Prototyping of Flyback Converter

Problem Statement:

Design and develop a hardware solution for a dual-output flyback converter that efficiently produces two regulated DC output voltages from a fixed DC input voltage, meeting the precise voltage and current specifications below. You may consider that this designed supply will be used in driving the power electronics switches, cooling system, and sensing circuit.

Common specifications to be followed by all the groups. Ensure that your design meets the following criteria;
 i) Output voltage ripple < 5%
ii) Load voltage regulation < 10% (specified over the load range 10% to 100% of full load)
iii) Line voltage regulation<1%

Group No.	Input Voltage	Output Specification
1	9-36V	**Port 1: +12V,1.6A** **Port 2: -12V,-1.6A**
2	12-24 V	**Port 1: +5V, 2.5A** **Port 2: -5V,-2.5A**
3	5-12 V	**Port 1: +15V, 1A** **Port 2: -15V, -1A**
4	12-24 V	**Port 1: +10V, 2A** **Port 2: -10V,-2A**
5	9-36V	**Port 1: +15V, 1A** **Port 2: -15V,-1A**
6	18-36 V	**Port 1: +12V, 1.6A** **Port 2: -12V,-1.6A**
7	18-36 V	**Port 1: +5V, 3A** **Port 2: -5V,-3A**
8	5-12 V	**Port 1: +10V, 1.7A** **Port 2: -10V,-1.7A**

Important parameters to be taken care of while designing the DC power supply:

i) A custom transformer should be designed for the flyback converter to match the input and output voltage and current requirements.

ii) Precise voltage regulation mechanisms for both output channels should be implemented to ensure stable output voltages using analog control.

iii) Over-voltage, over-current & short-circuit protection features should be included in the design; there are different ways you can do this; you can think of any of them.

iv) Address the potential effects of parasitics, which can adversely impact the converter's performance & optimize the design to minimize the effect of parasitics.

v) Design should be compact and cost-effective.

Marks distribution:

Hardware Results: 10; Viva: 10; Presentation: 10

 Date of Presentation: 3rd Nov 2023

Logistics:

i) Every group needs to be present in the lab during lab hours, i.e., each Wednesday, 2:00 p.m.-5:00 p.m.

ii) One TA will be assigned to each group for the entire duration of the project. You can discuss with your assigned TA during the lab hours.

iii) Every two weeks, your progress will be recorded, and viva will be taken during lab hours.

iv) If you feel that you require more time to spend in the lab other than the lab hours, please inform the RAs beforehand.

v) Each group should stick to one table as per their group number during the entire project duration.

vi) Each group will be provided with a toolkit box at the beginning of the project. Once the project is finished, the toolkit box must be returned to the lab authority. If anything in the toolkit box is found to be damaged/missing, then the corresponding group has to take responsibility to fix/replace it; otherwise, no marks will be allotted for the project.

vii) Every group needs to arrange the necessary components on their own. The total amount will be refunded upon submitting a GST invoice and a bank account statement as proof of payment. NOTE that up to only 500 Rs will be reimbursed per group.

viii) Print your PCB from the "PCB Lab" of IIT Bombay. No amount will be refunded if any group prints the PCB from outside.

ix) You are allowed to use the resources of the Electrical Machines Lab only. Do not bring any equipment from the other labs without permission of the professor/instructor for this lab.

x) Must follow all the safety procedures, including wearing shoes in the lab.

xi) Turn on the power supply only after TA/RA checks your circuit and only in their presence.

PCB Printing Form: https://www.ee.iitb.ac.in/~pcblab/jobformPrototype.htm

TA Distribution

Group No.	TA
1.	Aditya Aman
2.	Akash Gangwar
3.	Ankam Karthik
4.	Biswajit Sahoo
5.	Gyana Manjari Sahoo
6.	Saurabh Singh
7.	Surbhi Mittal
8.	Siva Prabhakar

Corresponding TAs for the Project are – Biswajit Sahoo, Gyana Manjari Sahoo, Surbhi Mittal

Some useful resources:

i) https://youtu.be/-efYc_h28Kw?feature=shared

ii) https://youtu.be/pjkghX6uOoA?feature=shared

iii) https://youtu.be/XTURnO6MYck?feature=shared

iv) https://youtu.be/3_s7yAOuPaw?feature=shared

v) https://youtu.be/udptHumklqU?feature=shared

vi) PMP7453 reference design | TI.com

vii) LM34xx How to Design Flyback Converter with LM3481 Boost Controller (Rev. A) (ti.com)

viii) Under the Hood of Flyback SMPS Designs Article