

ROBOTICS AND COMMUNICATIONS SYSTEMS ENGINEERING TECHNOLOGY
LINEAR REGULATORS & SWITCH MODE POWER SUPPLIES LAB
3RD SEMESTER, SR. INSTRUCTOR TIM LEISHMAN

General Objective:

Upon completion of this lab, the student will be able to:

- A. Document the characteristics of a linear regulator
- B. Use a linear regulator to regulate voltage & current
- C. Calculate & Measure heat-sink power dissipation capabilities
- D. Document types & characteristics of a SMPS (Switch Mode Power Supply)
- E. Design a SMPS
- F. Develop a SMPS troubleshooting procedure/check-list
- G. Explain the advantages and disadvantages of SMPS over Linear Regulated power supplies

References:

- Theory notes
- First Year Text & Lab books
- [LM317T Datasheet](#)
- [BS170 Datasheet](#)
- [IRF9Z24N Datasheet](#)
- [RN116-1.5-02-10M Inductor Datasheet](#)
- [Heatsink HSE-20635-035H-W Datasheet](#)
- [TL494](#)
- [MC34063ACN](#)

Check-Off Sheet:

- [Check-Off Sheet](#)

Specific Objectives:

1. Review the LM317 linear regulator data sheet and document important specifications & features. (**Instructor Check**)
2. With a 40VDC input, configure the LM317 to regulate an output of _____ VDC. (**Instructor Check**)
3. With a 40VDC input, configure the LM317 to have a variable 5VDC to 25VDC output. (**Instructor Check**)
4. With a 40VDC input, configure the LM317 to have fixed current limiting of _____ mA. (**Instructor Check**)
5. With a 40VDC input, configure the LM317 to have variable 0.2A to 1A current limiting. (**Instructor Check**)
6. Show in your lab book how you would achieve variable voltage and variable current limiting in one circuit using LM317s.

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7. Review Heatsink calculations and calculate the max power dissipation of the HSE-20635-035H-W heatsink. **(Instructor Check)**
8. Use the LM317s thermal regulation ability to test and measure the max power dissipation of the HSE-20635-035H-W heatsink. Compare calculated vs. measured values. **(Instructor Check)**
9. Discrete Unregulated SMPS - With 40VDC input, design and use a function generator PWM at 100Khz to verify variable output voltage (5V to 25V) with a 1K Ω load. **(Instructor Check)**
10. Discrete Unregulated SMPS – Adjust the circuit from step 9 to provide a voltage output of 25V and incrementally test up to a max current of 1amp. **(Instructor Check)**
11. Discrete Regulated SMPS – Review the datasheet and document all important specifications and functions of the TL494 IC. Functionally test and document the voltage control PWM operation/functions of the TL494 at 100Khz. **(Instructor Check)**
12. Discrete Regulated SMPS – Using the circuit from step 10, replace the function generator with the TL494 to achieve voltage regulation. Show schematic and demonstrate circuit operation and regulation. **(Instructor Check)**
13. Discrete Regulated SMPS – Modify the previous circuit to achieve variable voltage range of, at minimum, 5V to 25V. Show schematic and demonstrate circuit operation.
14. MC34063ACN – Review the datasheet and document all important specifications and functions of the MC34063ACN IC. **(Instructor Check)**
15. Design a Buck circuit using the MC4063 using a 30V input and a Vout of _____ VDC. **(Instructor Check)**
16. Design a Boost circuit using the MC4063 using a 5V input and a Vout of _____ VDC. **(Instructor Check)**
17. Design an Inverter using the MC4063 using a 5V input and a Vout of _____ VDC. **(Instructor Check)**
18. Develop a SMPS troubleshooting procedure for a second-semester student
19. Explain the advantages and disadvantages of SMPS over Linear Regulated Power Supplies.
20. Complete Conclusion and submit completed Check-Off sheet and Lab writeup in Moodle.