ROBOTICS AND COMMUNICATIONS SYSTEMS ENGINEERING TECHNOLGY
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.

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 1KΩ 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.