

ECEN303 2020 Assignment 2

Thermal Analysis and Voltage Regulation

Course contribution: 10%

Total Marks: 75

Due: 15 May 1159pm online.

Question 1: [25 Marks]

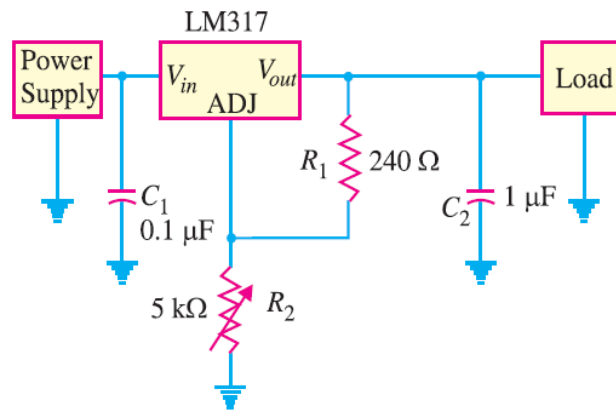
- Explain the purpose of heat sinks. Also, why do we include an insulating washer between the transistor and the heat sink?
- What is the difference between LM7806 and LM7912?
- What are the basic types of switching regulators and how do they differ? What are the basic difference between switching and linear regulators and where do we use them?
- What are the main requirements for selecting a voltage regulator for your design?

Question 2: [5, 25Marks]

- The data sheet of a 2N3055 lists a power rating of 115 W for a case temperature of 25°C. If the derating factor is 0.657 W/°C, what is $P_{D(max)}$ when the case temperature is 90°C?
- A TO-220 case MOSFET has to dissipate 13W. If T_{jmax} is 150°C and T_{amax} is 50°C, a) Select a suitable MOSFET from the market b) Select a suitable Heatsink
- Perform the thermal analysis for all the situations (No heat sink, Heatsink, and Heatsink with forced convection) using the tutorial. Document your analysis clearly.

Question 3: [3, 4, 3, 5, 5 Marks]

- A power supply has $V_{NL} = 15$ V and $V_{FL} = 14.5$ V. What is the load regulation?
- A voltage regulator is rated at an output current of $I_L = 0$ to 40 mA. Under no-load conditions, the output voltage from the circuit is 8V. Under full-load conditions, the output voltage from the circuit is 7.996 V. Determine the load-regulation for the circuit.
- If line voltage changes from 218 to 235 V and load voltage changes from 12 V to 12.6 V, what is the line regulation?
- If R_2 in the following figure is adjusted to 1.68 k Ω , determine the regulated DC output voltage for the LM317.



- e) The zener diode in the following figure has a minimum zener current of 3 mA and maximum zener current of 100 mA. Determine the minimum allowable value for the load resistor R_L ?

