Department of ECE, Bennett University

EECE105L: Fundamentals of Electrical and Electronics Engineering

Tutorial Sheet-11

Topics Covered: Zener Diode-Voltage regulator

1. Consider the circuit shown in Fig. 1. Given that, V_{in} = 40 V, R = 50 Ω, R_L = 100 Ω and V_z =20 V. Answer the following questions.

    i)   Compute the voltage drop across the load resistance R_L?

    ii)   Calculate the current through the load resistor R_L.

    iii)   What is the voltage dropped across R?

    iv)   Calculate the current through R.

    v)   What is the current through the Zener diode?

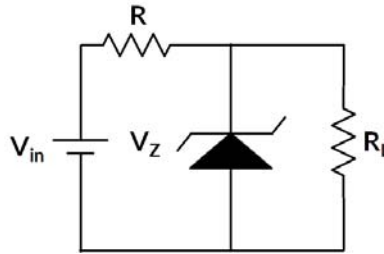   vi)   What is the power consumed by Zener diode?

Fig. 1

2. Consider the circuit shown in Fig. 1. Given that, R = 4 kΩ, R_L = 10 kΩ and V_z =30 V. The input voltage V_{in} can vary between 70 to 100 V. Answer the following questions.

    i)   What is the range of voltage drops across R?

    ii)   Calculate the maximum and minimum currents through R?

    iii)   What is the current in the load resistor?

    iv)   Calculate the maximum and minimum currents through the Zener diode.

    v)   What is the minimum power rating of Zener diode that needs to be used in the circuit?

3. Consider the circuit shown in Fig. 1. Given that, the voltage drop across R_L is 12 V, V_{in} ranges between 20 V and 35 V. The minimum current through R_L is 100 mA and the minimum current through the Zener diode is 8 mA. Answer the following questions.

    i)   What is the rating of the Zener diode?

    ii)   What is the minimum voltage dropped across R?

    iii)   What is the minimum current through R?

    iv)   Calculate the value of R_L.

v) Calculate the value of R.

4. Over what range of input voltage will Zener circuit shown in fig. 1 will maintain a voltage 30 V across a 2 kΩ load? Assume R = 200 Ω, $I_{Z,max}$ = 25 mA.

5. Design a voltage regulator in which the voltage across the load is 12 V. Given, input voltage is 16 V, the current through the load varies between 0 – 200 mA. Find the rating of Zener diode.

------------- END OF QUESTIONS -------------

Solutions:

1. i) 20 V ii) 0.20 A iii) 20 V iv) 0.40 v) 0.20 A vi) 4 W
2. i) 40 V to 70 V, ii) I_{max} = 17.5 mA, I_{min} = 10 mA iii) 3.0 mA iv) I_{max} = 14.5 mA, I_{min} = 7 mA v) 435 mW
3. i) 12 V ii) 8 V iii) 108 mA iv) 120 Ω v) 74 Ω
4. $V_{in,min}$ = 33 V, $V_{in,max}$ = 38 V,
5. R = 20 Ω, P_{ZM} = 2.4 W