Power Supply and Zener Regulator Problems

Q.1 Refer to figure 1 and complete the following

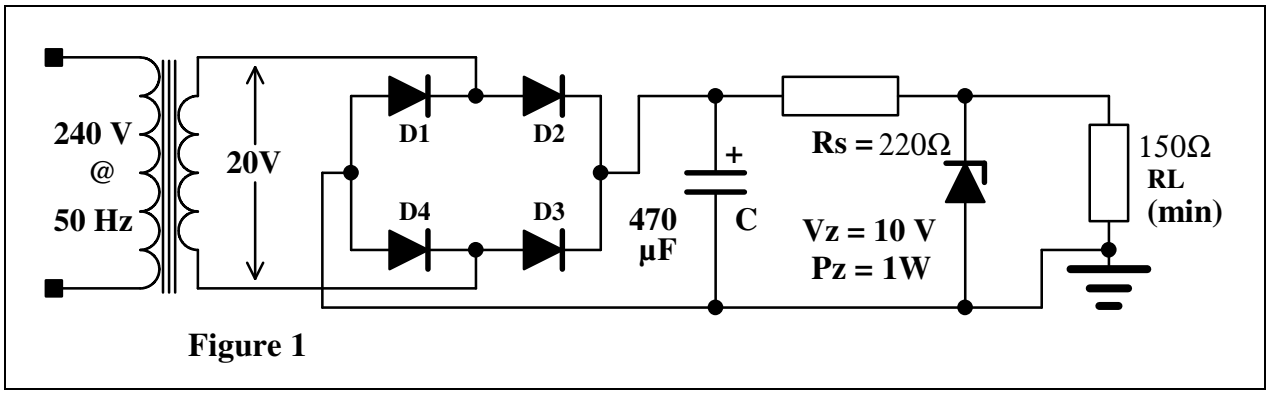

Figure 1

i) Iz(max) = _____

ii) Iz(min) = _____

iii) I_L (max) = _____

iv) $V_{(ripple)}$ p-p = _____

v) Vdc (across C) = _____

_____

_____

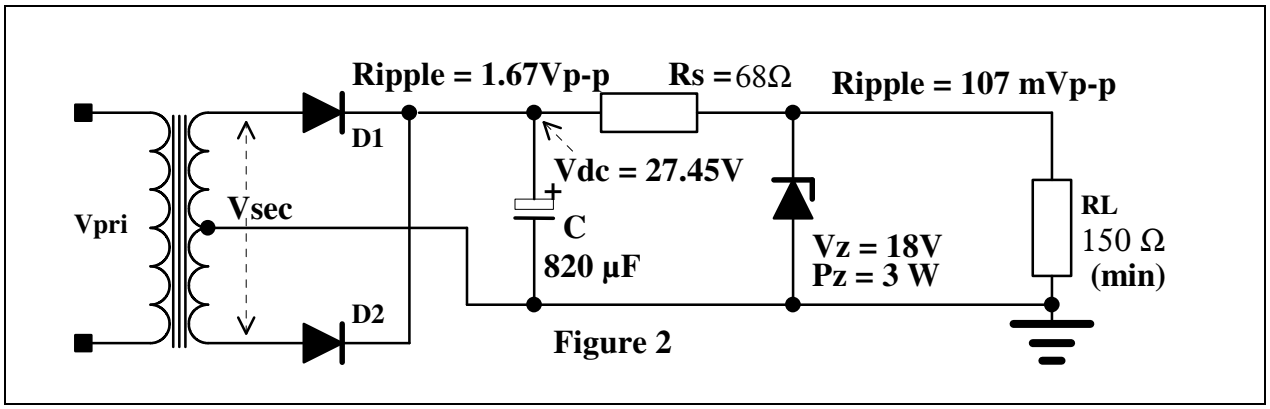

Figure 2

Rs = _____

_____

vii) Current through the zener if R_L is open circuit = _____

viii) Voltage across R_L if it was a value of 100Ω = _____

_____

Q.2 Refer to the circuit of figure 2 and complete the following.

i) I_L (max) = _____

ii) I_{Rs} = _____

iii) P_{Rs} = _____

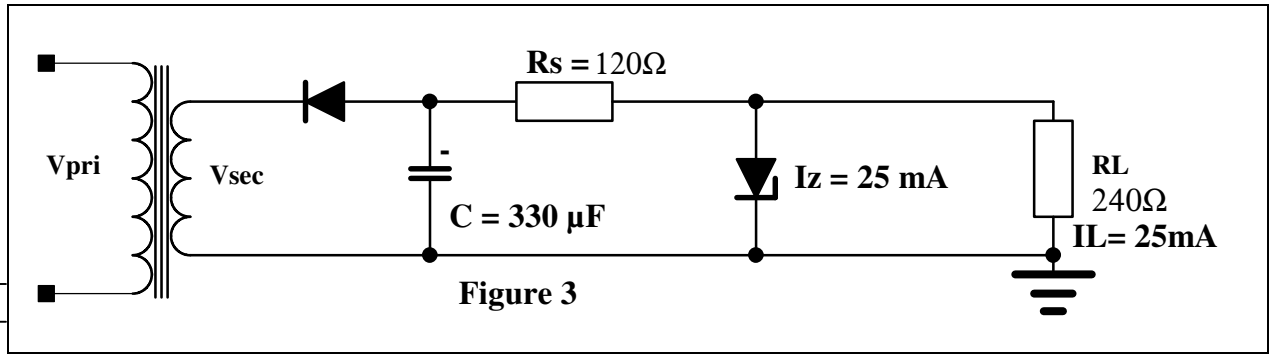

Figure 3

v) The ripple reduction factor of the regulator circuit = _____

vi) the output voltage if the zener went open circuit = _____

vii) The regulation percentage of the power supply if the voltage across the zener went to 18.7 V with R_L open circuit.

Q.3 Refer to figure 3 and complete the following

i) Value of Vz = _____

ii) Select a minimum available power rating for the zener. = _____

_____

iii) Ripple voltage across C = _____

_____

iv) Voltage drop across Rs = _____

_____

v) Value of the transformer secondary voltage = _____

_____

_____

vi) The approximate voltage supplied to the load if the zener diode became open circuit = _

_____

vii) The current through the zener if R_L become open circuit. = _____

_____

Equations

Transformers

$$\frac{Npri}{N\sec} = \frac{Vpri}{V\sec} = \frac{I\sec}{Ipri} \qquad V\sec pk = V\sec \times \sqrt{2}$$

Rectifier Systems (Unfiltered)

$V_{RL_{(pk)}} = V\sec_{(pk)} - Vd$ Vd = 0.7 V for half wave and full wave center tapped transformer. 1.4 V for bridge circuit.

$Vdc = V_{RL(pk)} \times 0.318$ For half wave circuits.

$Vdc = V_{RL_{(pk)}} \times 0.637$ For full wave circuits

The above rectifiers are not used for dc power supplies used in electronic equipment but may be used for battery charging and power control (motor speed, heating electro-plating etc)

Rectifier Systems (Filtered)

$V_{RL(pk)} = V\sec_{(pk)} - Vd$ Vd = as for above

$Vdc = V_{RL(pk)} - \frac{Vripplep{-}p}{2}$ For **ALL** filtered supplies

$V_{ripple}p - p = \frac{Idc \times t}{C}$ Where C = value of the filter capacitor
t = period of ripple frequency (t = 1/f)

Zener Regulation

$Pz = Iz_{(\max)} \times Vz$ Transpose to find $Iz_{(max)}$

$Iz_{(\min)} = Iz_{(\max)} \times 0.1$ Value ensures that the zener is within the voltage regulation range.

$I_{Rs} = Iz + I_L$ Transpose for Iz once I_L is determined.

$I_{Rs} = \frac{Vdc{-}Vz}{Rs}$ Transpose for Rs if I_{Rs} is known.

Ripple reduction factor = $\frac{Vripple(in)}{Vripple(out)}$