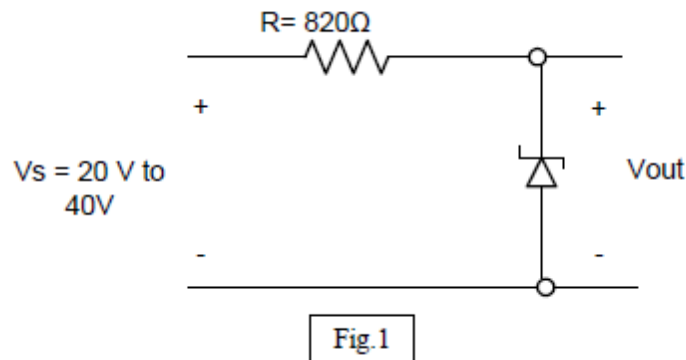


## Sheet 3: Zener Diodes

### Problem 1

Suppose the Zener diode of Fig.1 has a breakdown voltage of 10V and  $r_z$  of  $10\Omega$ ; what are the values of the Zener current at the minimum and maximum values of ' $V_s$ '?

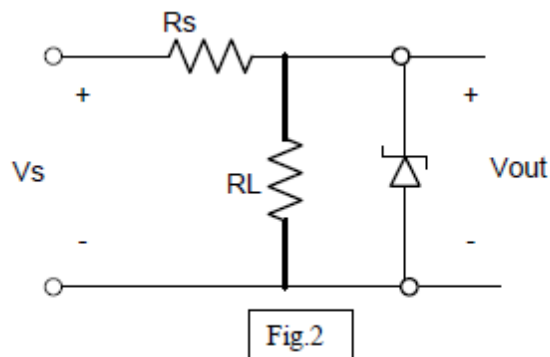
(Ans.  $I_{D,min}=11.9mA$ ,  $I_{D,max}=35.7mA$ )



### Problem 2

Fig.2 circuit components has these values:  $V_s=18V$ ,  $V_Z=10V$ ,  $r_z=10\Omega$ ,  $R_s=270\Omega$  and  $R_L=1k\Omega$ . Is the Zener diode operating in the breakdown region? What is the value of the Zener current?

(Ans. : it's working in breakdown,  $I_D=18.73mA$ )



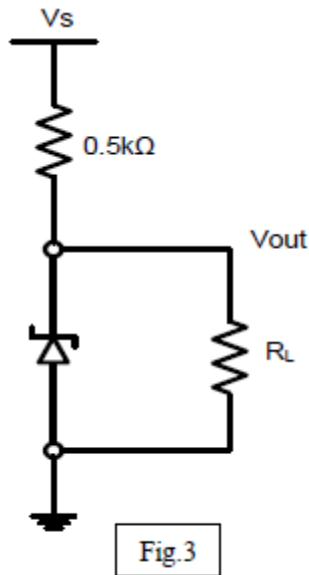
### **Problem 3**

For the circuit shown in Fig.3; the Zener diode has the following parameters:  $V_{Z0}=6.7V$ ,  $r_Z=20\Omega$ ,  $I_{Zmin}=0.2mA$  and the source voltage  $V_s=10V$ . Calculate the following:

1.  $V_{out}$  with no load connected to the circuit ( $R_L=\infty$ )
2.  $V_{out}$  at  $R_L=2k\Omega$
3.  $V_{out}$  at  $R_L=0.5k\Omega$

What is the minimum value for  $R_L$  for which the Zener diode still operates in the breakdown?

(Ans.  $V_{out}=6.827V, 6.72V, 5V$ )



### **Problem 4**

Find  $V_{out}$  as a function in  $V_{in}$  and Draw  $V_{out}$  versus  $V_{in}$  for the shown circuits? sketch the time dependent output signal for each of the three cases given that,  $V_i = 15\sin(\omega t)$ ,  $V_z = 10V$ ,  $V_{th} = 0.7V$

