EE2002 2014/2015

TUTORIAL 4 (with answers at the back)

1.a) Determine the empirical diode junction equation for a 1N4005 diode given the following voltage and current values:

$V_{Dl} = 0.6V$ @ $I_{Dl} = 2.3mA$

$V_{D2} = 0.8V$ @ $I_{D2} = 245mA$

1.b) Use the empirical diode junction equation, obtained in 1(a), to calculate the diode voltage V_D for a 1N4005 diode when the diode currents is

$I_D = 20$ mA

$I_D = 300$ mA

1.c) A 1N4005 diode is used in the circuit shown in Fig.1, determine the diode voltage and current by means of successive iteration method.

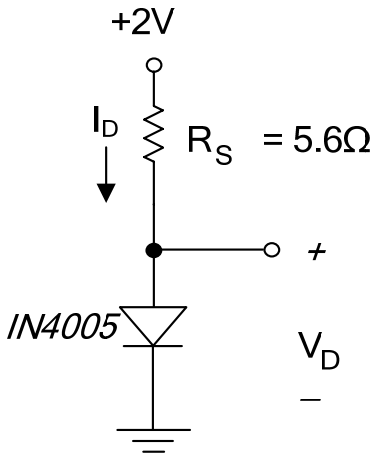

Fig. 1

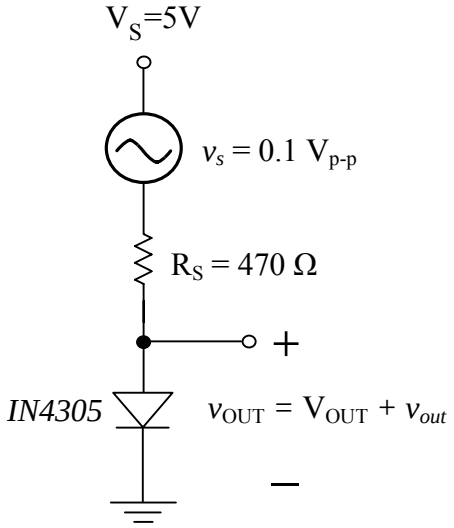

Fig. 2

2. Determine the AC component of the output voltage, v_{out}, for the circuit in Fig. 2 when $V_S = 5V$. The I-V characteristic of the IN4305 diode has the following voltage and current values:

$V_{D1} = 0.50V$ at $I_{D1} = 250\mu A$

$V_{D2} = 0.70V$ at $I_{D2} = 10mA$

3. Find the Q-points (I_D , V_D) of the diodes in the circuits of Fig. 3. Using the simple model for forward biased diode, the diode voltage is given as 0.75V.

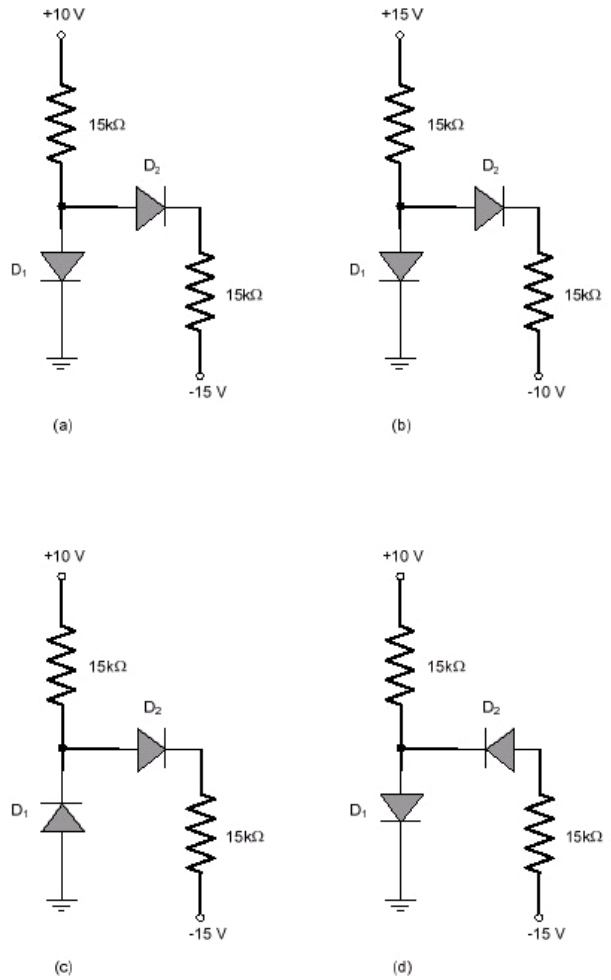

Fig. 3

Answers to Tutorial 4

1(a) The empirical junction equation for the IN4005 diode is

$$\mathbf{I_D \approx (1.90nA)e^{\frac{V_D}{(42.8\,mV)}}} \qquad \text{or} \qquad \mathbf{V_D \approx (42.8mV)ln\left[\frac{I_D}{1.90nA}\right]}$$

1(b) (i) For I_D=20 mA, V_D=0.692 V
(ii) For I_D=300 mA, V_D=0.808 V

1(c) I_D = 215 mA, V_D=0.794 V

2. v_{out} = 1.24 mV_{P-P}

	D_1	D_2
5(a)	0A, -2.13V	0.808mA, 0.75V
5(b)	0.283mA, 0.75V	0.667mA, 0.75V
5(c)	0.183mA, 0.75V	0.9mA, 0.75V
5(d)	0.617mA, 0.75V	0A, -15.75V