DEPARTMENT OF ELECTRONIC AND ELECTRICAL ENGINEERING

Spring Semester 2009 (30 minutes)

EEE 103 ANALOGUE CIRCUITS MID TERM TEST

Answer **ALL** questions. **The numbers given after each section of a question indicate the relative weighting of that section.**

REGISTRATION NUMBER:.....

WRITE YOUR ANSWERS ON THIS QUESTION PAPER

1 State the direction of conventional forward current flow (ie, "**A** to **B**" or "**B** to **A**") through the diode of figure 1. ***{1 mark}***

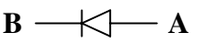


figure 1

Q1 Ans

2 In figure 2, D has a forward voltage drop of 0.7V. If $V_i = -4$V, will the diode be conducting? If the diode is conducting, what is its forward current? If the diode is not conducting, what is its reverse bias voltage? ***{2 marks}***

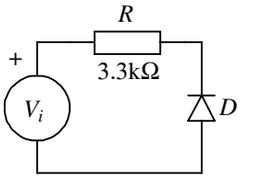


figure 2

Q2 Ans

3 In the circuit of figure 3 the diode has a forward voltage drop of 0.7V. At what value of V_i is the diode on the point of changing state from conducting to non-conducting? What is the value of I_D if **(a)**, $V_i = 6$V? and **(b)**, $V_i = -6$V? ***{3 marks}***

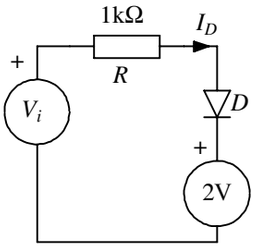


figure 3

Q3 Ans

4 In the circuit of figure 4, $R_1 = 2\text{k}\Omega$, $R_2 = 3\text{k}\Omega$ and $C = 1\mu\text{F}$ and V_i is shown in the **Q4** answer box. Evaluate the circuit time constant, τ, and values of V_O and I_C at $t = 0 + \delta t$ and at $t = 10\text{ms} + \delta t$ where δt is very small. Sketch the responses, V_O and I_C, of figure 4 on the axes given in the **Q4** answer box. ***{9 marks}***

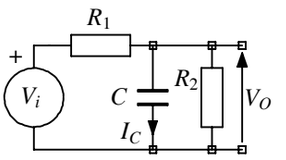
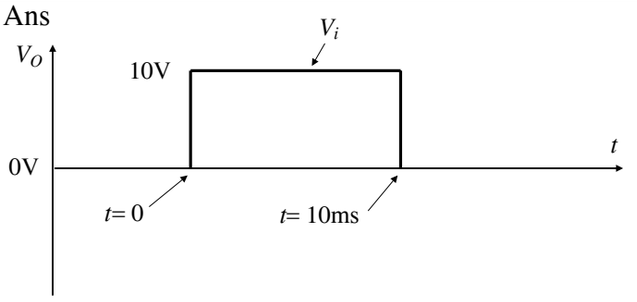
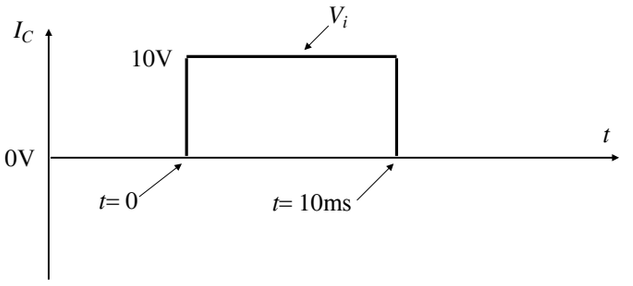


figure 4

Q4 Ans





$\tau =$

$V_{O\ (t = 0 + \delta t)} =$

$V_{O\ (t = 10\text{ms} + \delta t)} =$

$I_{C\ (t = 0 + \delta t)} =$

$I_{C\ (t = 10\text{ms} + \delta t)} =$

5 On the graph of V_i in the **Q5** answer box, sketch the response, V_O, of the circuit of figure 5 to the input voltage, V_i, shown. Label the magnitude of any step changes in V_O. Write down the circuit time constant. ***{5 marks}***

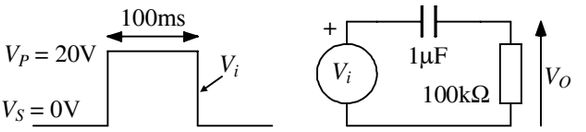
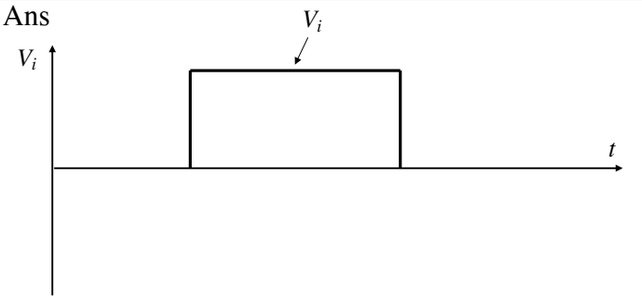


figure 5

Q5 Ans



$\tau =$

6 On the axes in the **Q6** answer box, sketch the waveshape you would expect to observe for a signal described by $V(t) = 4e^{-t/\tau} - 1$ for $t > 0$ and label all its important features. ***{4 marks}***

Q6 Ans

7 The diode in figure 7 has a forward voltage drop of zero. On the axes in the **Q7** answer box, sketch the response of the circuit of figure 7 to the input pulse shown. Write down the rising and falling edge time constants in the boxes provided. ***{3 marks}***

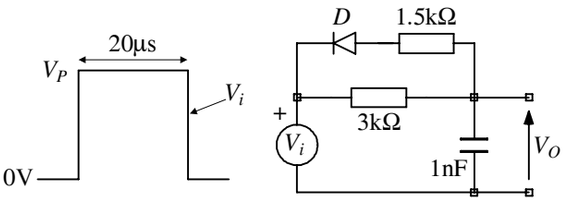
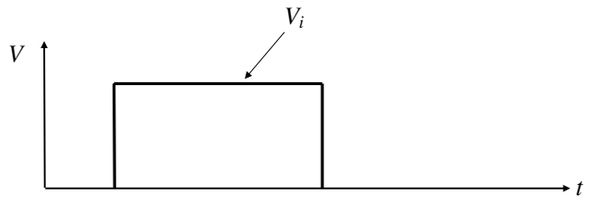


figure 7

Q7 Ans



rising edge time constant =

falling edge time constant =

8 In figure 8 there are 5 circuit shapes that you have come across. In the **Q8** answer box, associate each circuit with the appropriate name from the following list;

half wave rectifier, clipping circuit, clamping circuit, zener diode regulator, full wave rectifier, voltage doubler, peak detector. ***{5 marks}***

Q8 Ans
circuit **(a)** is a .....
circuit **(b)** is a .....
circuit **(c)** is a .....
circuit **(d)** is a .....
circuit **(e)** is a .....

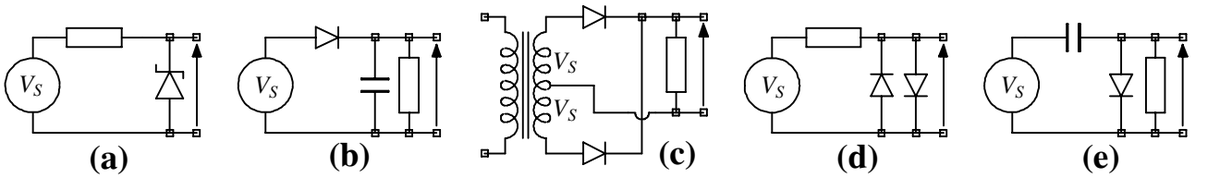


Figure 8

9 If V_S in the circuits of figure 8 is a 10V peak 50 Hz sinusoid, the diodes have a forward bias voltage drop of 0.7V and you can assume where necessary that the resistor is large, what is

(i) the most negative voltage at the output of circuit **(e)**?

Q9(i) Ans

(ii) the range of voltage that can appear at the output of circuit **(d)**?

Q9(ii) Ans

(iii) the waveshape you would expect to see at the output of circuit **(c)**? *(You need to draw axes and label peak values and times.)*

Q9(iii) Ans

(iv) the most posive voltage at the output of circuit **(b)**? ***{6 marks in total}***

Q9(iv) Ans