Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(TAKE HOME)
SEMESTER I
SESSION 2020/2021

COURSE NAME	:	ELECTRONICS
COURSE CODE	:	DAE 21303
PROGRAMME CODE	:	DAE
EXAMINATION DATE	:	JANUARY / FEBRUARY 2021
DURATION	:	12 HOURS
INSTRUCTION	:	ANSWERS **ALL** QUESTIONS OPEN BOOK EXAMINATION

THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

Q1 The circuit of **Figure Q1** is a diodes application. V_{red} is the supply voltage of a home plug. The transformation ratio between the primary and the secondary is *26:1* meanwhile V_{red} = *220* V_{rms}, f_{in} = *50 Hz*, R_L= *300* Ω and the first model diode characteristic is practiced.

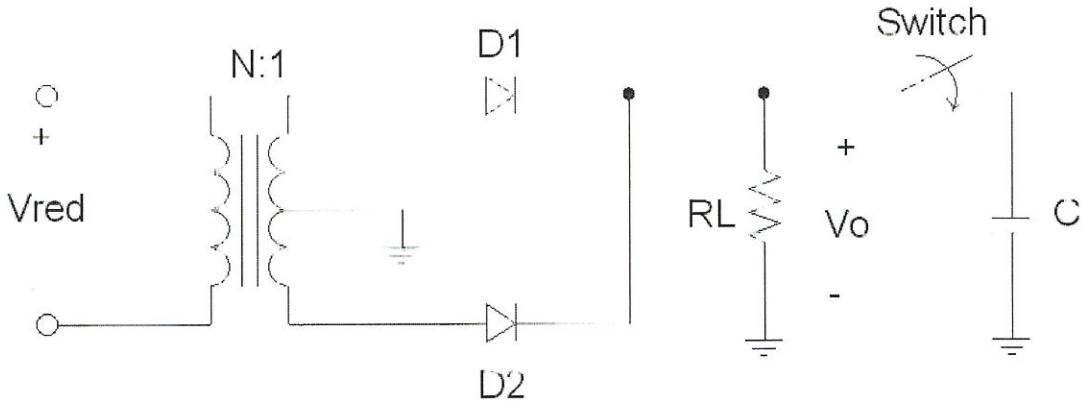


Figure Q1

(a) Consider the switch open initially (*C* offline).

(i) Indicate giving reasons what type of circuit is and propose an application.
(2 marks)

(ii) Plot in **Graph Q1(a)** the following voltage signals: anode voltage of each diode V_{a1} and V_{a2} and the output voltage V_o. State the most significant voltage and time values. Mark in V_o in which half-wave is ON each diode.
(6 marks)

(iii) Calculate the value of the Peak Inverse Voltage (PIV) in each diode.
(2 marks)

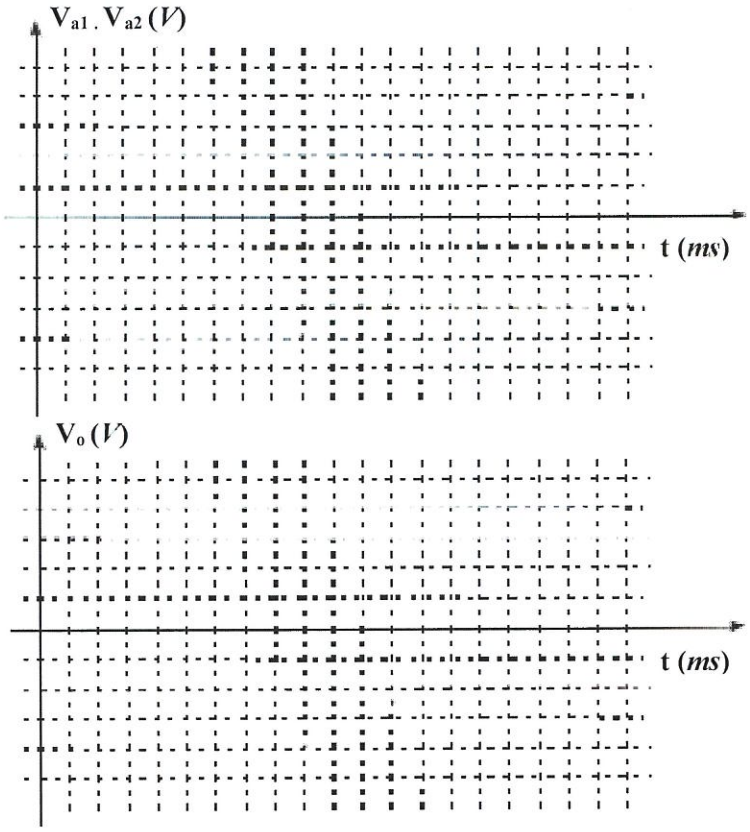
(b) Hereinafter consider the switch closed (*C* connected to the circuit).

(i) Plot in **Graph Q1(b)** the ripple voltage of value *1V* peak-peak observed in an oscilloscope in *AC* mode.
(6 marks)

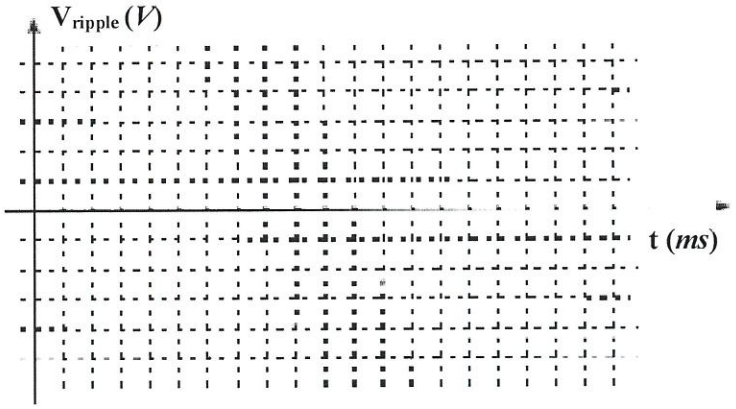
(ii) Calculate the capacitor *C* to obtain a ripple voltage up to *1V (peak-peak)*.
(2 marks)

(iii) Calculate the increase of the DC voltage V_o that is obtained by connecting the capacitor *C*.
(2 marks)

Please submit this sheet with the plotted graph.



Graph Q1(a)



Graph Q1(b)

Q2 (a) Each diode in **Figure Q2(a)** is a complete model diode with threshold voltage equal to V_D and an internal resistance equal to r_d. Diode *D1* and *D2* are germanium diodes with $V_D = 0.3V$ and $r_{d1} = 30\Omega$, whereas *D3* and *D4* are silicon diodes with $V_D = 0.7V$ and $r_{d2} = 20\Omega$.

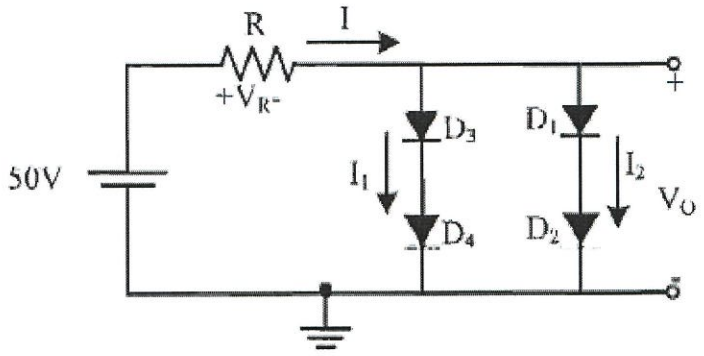


Figure Q2(a)

(i) If $R = 10\ k\Omega$, calculate I, I_1, I_2, V_R and V_o.

(6 marks)

(ii) Repeat **Q2(a)(i)** if $R = 1\ k\Omega$.

(3 marks)

(iii) Predict the condition of circuit when the polarity of the battery reversed. Calculate V_o.

(1 mark)

(b) **Figure Q2(b)** shows a rectifier circuit connected to a filter capacitor and a zener diode, D_1. Given that $I_{zmax} = 60\ mA$ and $I_{zmin} = 3\ mA$. From the circuit, determine the following parameters:

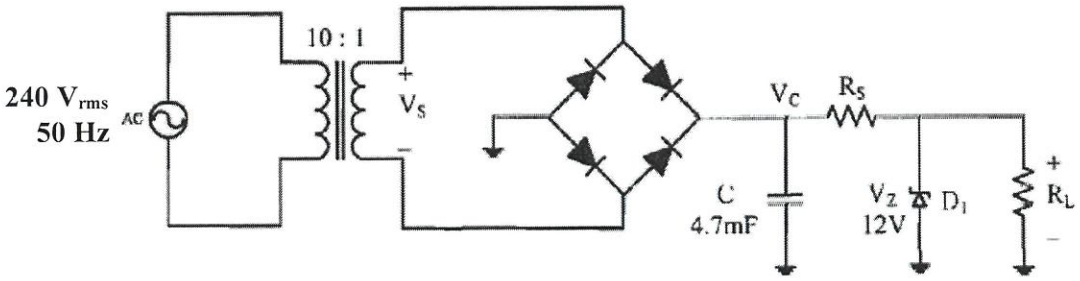


Figure Q2(b)

(i) Sketch V_c with respect to the input signal, V_s.

(2 marks)

(ii) Average value of V_c if $V_{r(p-p)} = 2\ V$.

(2 marks)

(iii) The range of R_s if $500\ \Omega \leq R_L \leq 1k\ \Omega$.

(6 marks)

Q3 (a) Referring to **Figure Q3(a)**, given $\beta = 80$ and $r_o = 40\ k\Omega$.

(i) Draw the AC equivalent circuit using r_e model.

(3 marks)

(ii) Determine the AC dynamic resistance, r_e.

(9 marks)

(iii) Determine the input impedance, Z_i and output impedance, Z_o for the circuit.

(4 marks)

(iv) Calculate the voltage gain, A_v.

(2 marks)

(v) If the input voltage, $V_{in} = 10\ mV$ is connected to the circuit, find the output voltage, V_o.

(2 marks)

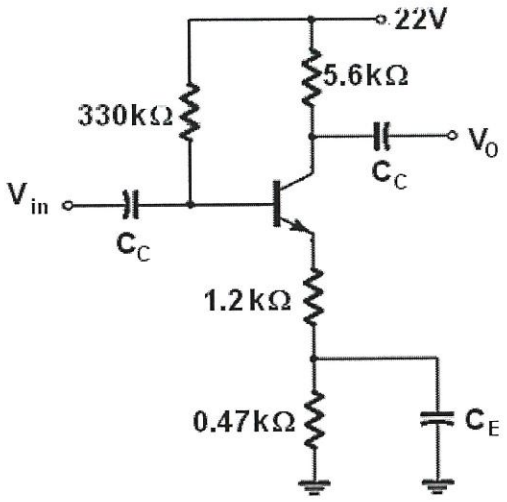


Figure Q3(a)

Q4 (a) Differentiate between Bipolar Junction Transistor (BJT) and Field Effect Transistor (FET).

(4 marks)

(b) **Figure Q4 (b)(i)** shows a voltage divider bias FET circuit. Find the required values for R_S and R_D if the FET transfer characteristics curve with the defined Q-point is as shown in **Figure Q4 (b)(ii)** and the following values are given: $V_{DD} = +16\ V$, $R_1 = 2.1\ M\Omega$ and $R_2 = 270\ k\Omega$, $V_{DS} = 7\ V$.

(8 marks)

(c) Find the input impedance, Z_{in} , output impedance, Z_o and the output voltage, V_o of the amplifier in part **Q4(b)** if the input signal, $V_i = 2\ mV$ and the ac output impedance, $r_d = \infty$.

(8 marks)

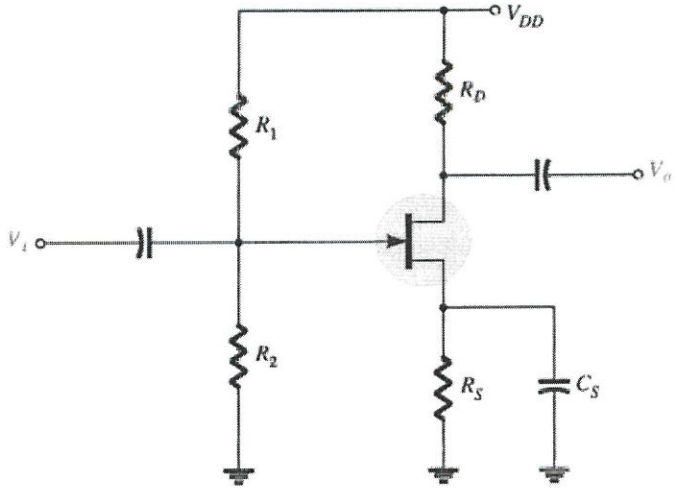


Figure Q4(b)(i)

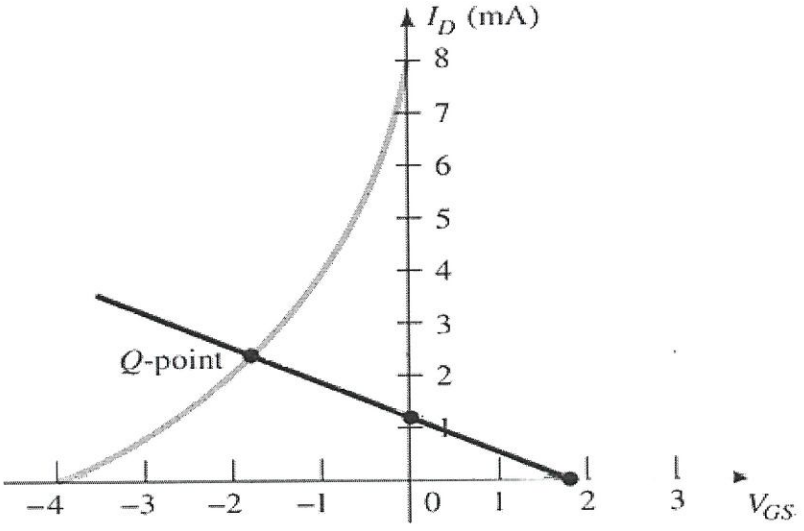


Figure Q4(b)(ii)

-END OF QUESTIONS –