UTHM
Universiti Tun Hussein Onn Malaysia

# UNIVERSITI TUN HUSSEIN ONN MALAYSIA

## FINAL EXAMINATION
## (TAKE HOME)
## SEMESTER II
## SESSION 2019/2020

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|---|---|---|
| COURSE NAME | : | ANALOG ELECTRONICS |
| COURSE CODE | : | BEJ 10503/BEL 10203 |
| PROGRAMME | : | BEJ/BEV |
| EXAMINATION DATE | : | JULY 2020 |
| DURATION | : | 6 HOURS |
| INSTRUCTION | : | ANSWER **ALL** QUESTIONS.<br>**OPEN BOOK EXAMINATION** |



THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

**Q1** The Common-Emitter configuration circuit is shown in **Figure Q1** with $V_{BE} = 0.7$ V.

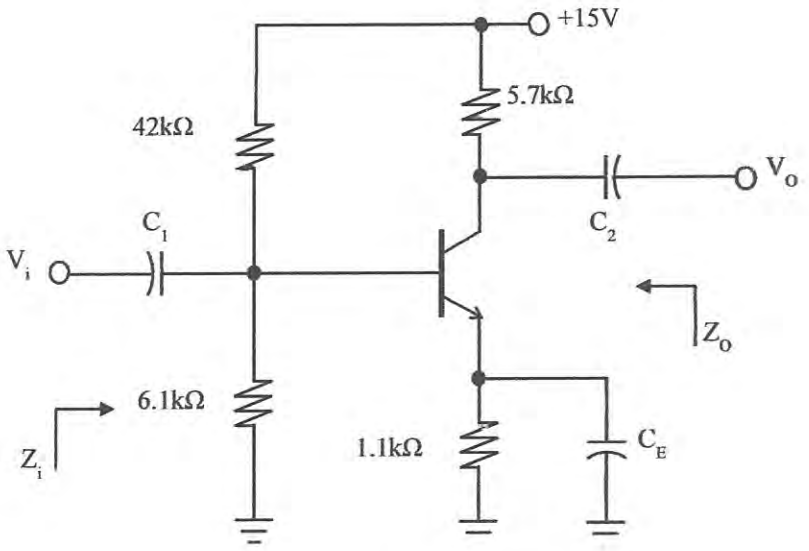


**Figure Q1**

(a) Name the type of the biased-circuit shown in **Figure Q1** and give **TWO (2)** advantages of this circuit compared to fixed biased-circuit.

(5 marks)

(b) Analyze the circuit and determine current, $I_B$, $I_C$ and $I_E$ and output voltage, $V_{CE}$.

(15 marks)

(c) If $R_E$ is removed from the circuit in **Figure Q1**, draw the small signal AC equivalent circuit using $r_e$ model for this new circuit.

(5 marks)

(d) Determine the input impedance, $Z_i$, output impedance, $Z_o$ and voltage gain, $A_v$ for the small signal AC equivalent circuit in part **Q1(c)**.

(10 marks)

**Q2** A Field Effect Transistor (FET) circuit has a MATLAB plot of the transfer characteristics curve and the bias line as in **Figure Q2**. Based on the specifications given as follows:
$V_{DD} = 15$ V, $V_{DS} = 5.475$ V and $I_1 = I_2 = \frac{V_{DD}}{R_1 + R_2} = 16.67\ \mu A$;

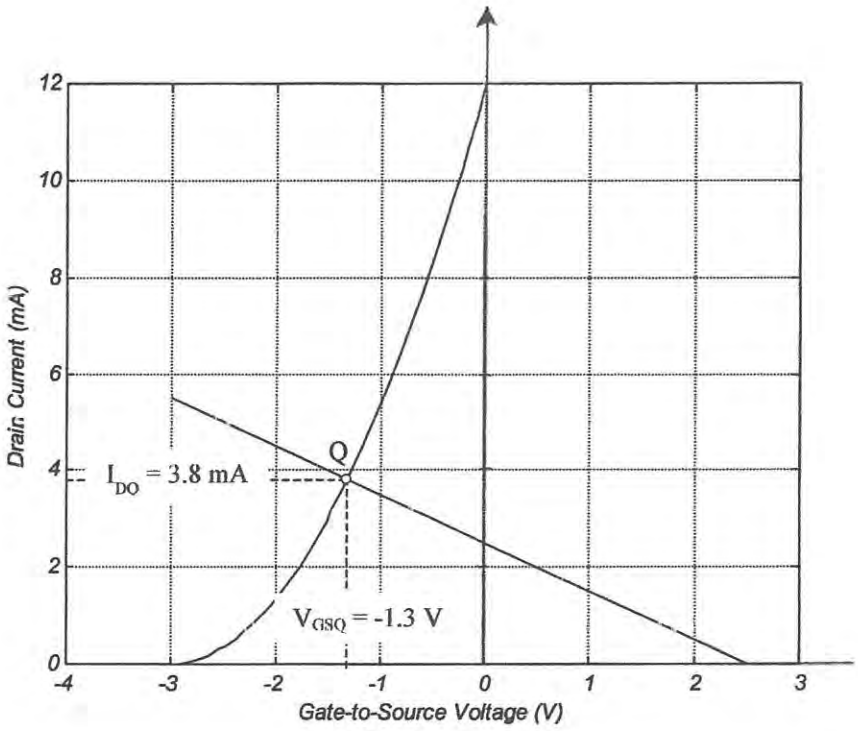


**Figure Q2**

(a) Design and sketch the Field Effect Transistor (FET) circuit (with bypass capacitor).
(10 marks)

(b) Determine the value of all resistors.
(15 marks)

(c) Draw the AC equivalent of the circuit.
(4 marks)

(d) Calculate its input impedance *Zi*, output impedance *Zo* and voltage gain *Av*. Assume $r_d \geq 10R_D$.
(6 marks)

**Q3** **Figure Q3** is an amplifier circuit that only amplifies the signals of specified frequencies. Assume that the BJT transistor has an infinite value of AC collector resistance, $r_o$ (or $r_C$) with $r_e = 28.48\,\Omega$, $R_S = 0.82\,k\Omega$ and $A_v = -72.91$;

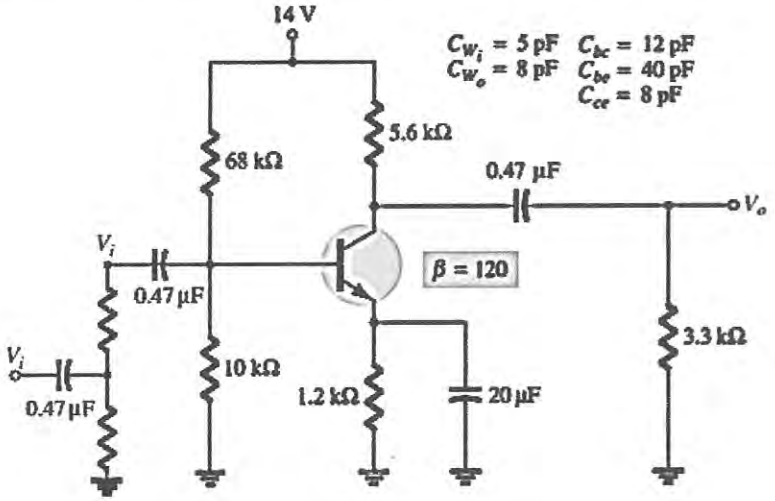


**Figure Q3**

(a) Sketch the high- frequency ac equivalent model of **Figure Q3**.

(8 marks)

(b) Determine the input high cutoff frequency, $f_{Hi}$ and output high cutoff frequency, $f_{Ho}$.

(15 marks)

(c) State the dominant high cut-off frequency, $f_H$.

(2 marks)

(d) Sketch the frequency response for high cut-off frequency.

(5 marks)

**- END OF QUESTIONS -**