الجامعة الإسلامية العالمية ماليزيا
INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA
يونيۏرسيتي إسلام انتارابغسا ملايسيا

KULLIYYAH OF ENGINEERING

END OF SEMESTER EXAMINATION
SEMESTER II, 2021/2022 SESSION

Programme	: **Engineering**	Level of Study	: **UG 2**
Time	: 2**:30 pm - 5:30 pm**	Date	: **07/07/2022**
Duration	: **3 Hrs**		
Course Code	: **EECE 2313**	Section(s)	: **1**
Course Title	: **Electronic Circuits**		

This Question Paper Consists of **4 (Four)** Printed Pages (Including Cover Page)
with **4 (Four)** Questions.

INSTRUCTION(S) TO CANDIDATES

- Total mark of this examination is **60.**
- This examination is worth **60%** of the total course assessment.
- Answer **ALL QUESTIONS.**
- Marks assigned to each problem are listed in the margins.
- **Note that one of the conditions to pass the course is to obtain at least 50 % of this examination.**

DECLARATION

By answering this final examination, I hereby declare that:

- The whole answer of this final examination is my own work.
- I do not receive any help from any other parties in answering on any part of this final examination.
- I do not give any clue, hint or work to other students in answering on any part of this final examination.
- I understand that any form of cheating or attempt to cheat is a serious offence, which may lead to dismissal.

Question 1 [15 marks]

(a) Derive the transfer function step by step for the *RC* circuit shown in **Fig. 1 (a)** and write the expression for the time constant(s). **(7 marks)**

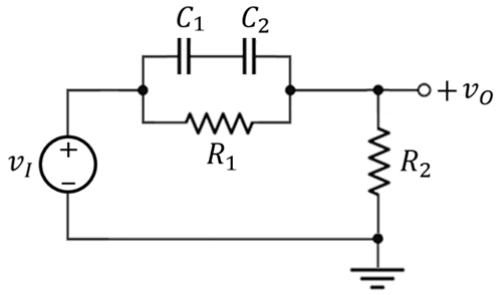

Fig. 1(a)

(b) Plot the Bode magnitude and phase for the following transfer function and determine the magnitude and phase at angular frequency 200 rad/sec. **(8 marks)**

$$T(s) = \frac{5 \times s(s+100)}{(s+10)(s+500)}$$

Question 2 [15 marks]

(a) Design a voltage amplifier as shown in **Fig. 2(a)** such that the magnitude of the amplifier can be operated within 20 Hz to 20 kHz assume that the transistor has small-signal hybrid-π parameters, $r_\pi = 3\ \text{k}\Omega$, $g_m = 40\ \text{mA/V}$, $r_o = \infty$ and negligible device capacitances. Also evaluate the overall voltage and current gains in terms of decibel (dB). **(10 marks)**

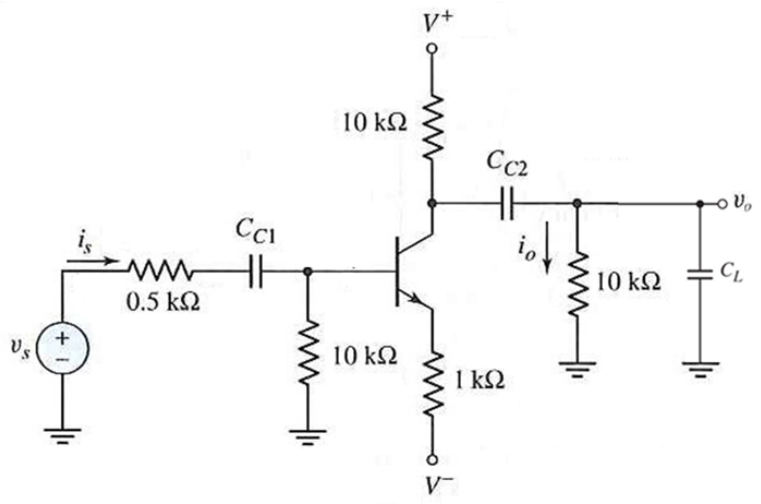

Fig. 2(a)

(b) A common drain amplifier as shown in **Fig. 2(b)** that operates at very high frequencies. The transistor parameters are, $g_m = 0.2$ mA/V and $r_0 = 100$ KΩ , $C_{gd} = 4$ pF and cutoff frequency, $f_T = 100$ kHz. [Given that, $R_{si} = 1$ kΩ, $R_1 = 68$ kΩ, $R_2 = 33$ kΩ, $R_D = 4$ kΩ, $R_s = 1$ kΩ, $R_L = 10$ kΩ $C_C = 10$ µF and $C_S = 100$ µF]. **(5 marks)**

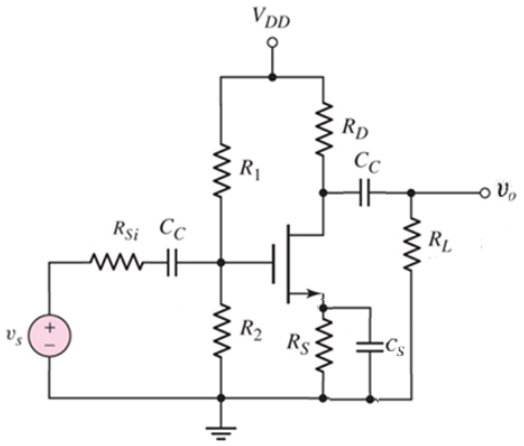

Fig. 2(b)

Question 3 [15 marks]

(a) Derive the expression for output current relation systematically of the BJT current source as shown in **Fig. 3(a)**. Assume that all the transistors are identical. **(4 marks)**

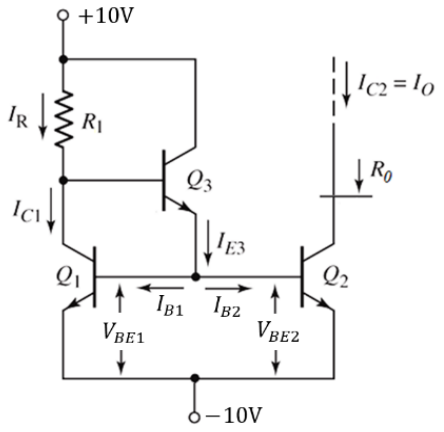

Fig. 3(a)

(b) Draw the small-signal equivalent circuit for the current source as shown in **Fig. 3(a)**. **(2 marks)**

(c) Design the circuit by determining the value of R_1 and output resistance R_O for the current source as shown in **Fig. 3(a)**. Assume that the transistors has the parameters, $\beta = 35$, $V_{BE1} = V_{BE2} = V_{BE3} = V_{BE}(\text{on}) = 0.7$ V, $V_A = 85$ V, and $I_O = I_{C2} = 15$ µA. **(4 marks)**

(d) Design the circuit to determine the (W/L) ratio for the MOSFET current source as shown in **Fig. 3(d)** and the output resistances R_{O1} and R_{O2} of the current source. Assume that all

MOSFET are identical and $I_{REF} = 1.2$ mA . The MOSFET has the parameters $k_n' = 0.13\ \text{mA/V}^2$, $V_{TN} = 1.2$ V and $\lambda = 2.5 \times 10^{-3}/V$ **(5 marks)**

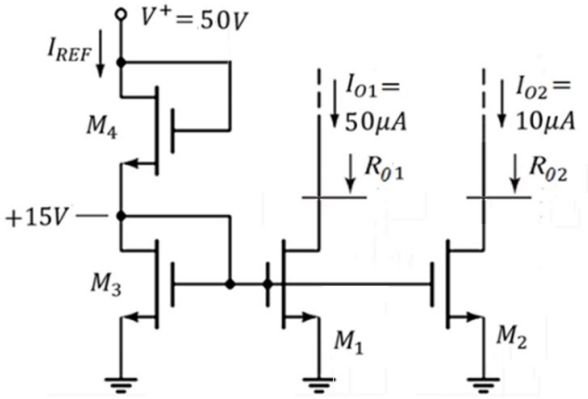

Fig. 3(d)

Question 4 [15 marks]

(a) The feedback current i_{fb} and error current i_ε of a feedback amplifier are 0.5 mA and 85 μA respectively. Determine the gain of the feedback amplifier. Assume that the open-loop gain of the current amplifier is 2.5×10^4. **(3 marks)**

(b) Derive the expression for close-loop voltage gain and feedback-factor systematically of the voltage amplifier as shown in **Fig. 4. (b).** **(4 marks)**

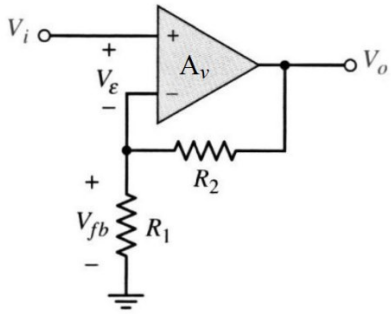

Fig. 4. (b)

(c) The bandwidth of an amplifier is extended 180 times after feedback. Determine the input and output resistances R_{if}, R_{0f} and gain A_{zf} after feedback. Assume that the input resistance, output resistance and gain without feedback of the series-series amplifier are, $R_i = 7.5$ kΩ, $R_0 = 5$ kΩ, $A_z = 1400$ Ω respectively and the bandwidth of the amplifier without feedback is 4.5 kHz . **(5 marks)**

(d) Draw the schematic and design an Op-amp based Wein Bridge Oscillator for generating frequency of 15.0 kHz. **(3 marks)**

END OF PAPER