INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA
END OF SEMESTER EXAMINATION
SEMESTER I, 2014/2015 SESSION
KULLIYYAH OF ENGINEERING

Programme : ENGINEERING
Level of Study : UG 2

Time : 2:30 pm-5:30 pm
Date : 30/12/2014
Duration : 3 Hrs

Course Code : ECE 2133
Section(s) : 1-2

Course Title : **Electronic Circuits**

This Question Paper consists of **Six (6)** Printed Pages with **Five (5)** Questions.

INSTRUCTION(S) TO CANDIDATES

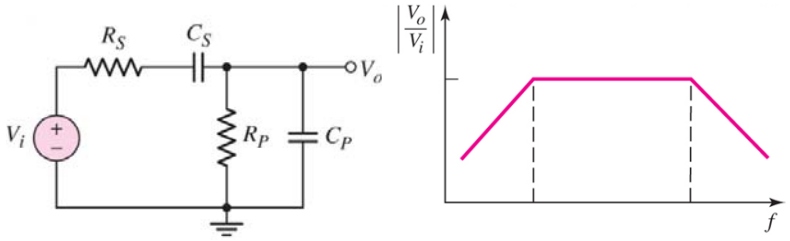
DO NOT OPEN UNTIL YOU ARE ASKED TO DO SO

- A total mark of this examination is **100**.
- This examination is worth **50%** of the total assessment.
- Answer **ALL FIVE (5)** questions.
- Useful formula and necessary parameters are given in page 6.

Any form of cheating or attempt to cheat is a serious offence which may lead to dismissal.

Q.1 [20 marks]

(a) Describe the effect of C_S and C_P of the circuit shown in **Fig. 1(a)** on the frequency response shown in **Fig. 1(b)**. **(10 marks)**



(a) **(b)**

Fig. 1

(b) Draw the frequency response curves, magnitude and phase of the following transfer function by applying Bode plot. **(10 marks)**

$$H(s) = \frac{10^6\, s(s+10)}{(s+100)(s+1)}$$

Q.2 [20 marks]

Draw the small signal equivalent circuit diagram in the midband frequency region of the circuit shown in **Fig. 2.** The circuit parameters are: Rsi = 0.1 kΩ, R_1 = 60 kΩ, R_2 = 40 kΩ, R_E = 0.4 kΩ, R_C = 10 kΩ, R_L = 10 kΩ and neglecting the effect of C_L. The transistor has small-signal hybrid-π parameters, r_π = 3 kΩ, g_m = 40mA/V and $r_o = \infty$ kΩ.

Analyze the circuit by finding the followings:

(i) The small signal voltage gain, $A_v = \frac{v_o}{v_i}$ in midband range. **(4 marks)**

(ii) The input resistance, R_i. **(4 marks)**

(iii) The equivalent output resistance, R_o. **(5 marks)**

(iv) The lower corner frequency due to C_C = 10 μF. **(5 marks)**

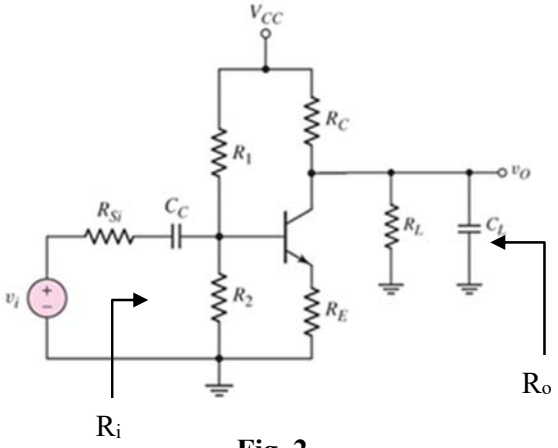


Fig. 2

What will be the midband voltage gain if R_E is short circuited of the circuit of **Fig. 2**? **(2 marks)**

Q.3 [20 marks]

The common source amplifier is shown in **Fig. 3** that operated at high frequencies. The transistor parameters are: $g_m = 40$ mA/V and $r_o = \infty$, $C_{gd} = 35$ pF, and $C_{gs} = 4$ pF and $C_L = 5$ pF.

(i) Draw the simplified high-frequency small signal equivalent circuit diagram. **(3 marks)**

(ii) How do you find Miller capacitance? What is the value of Millar capacitance. **(6 marks)**

(iii) Evaluate the upper 3dB frequency (f_H) considering Miller capacitance **(3 marks)**

(iv) Evaluate the upper 3dB frequency (f_H) without considering Miller capacitance. **(3 marks)**

(v) Evaluate the upper 3dB frequency (f_H) considering load capacitance $C_L = 5$ pF. **(4 marks)**

(vi) How do you evaluate the the upper 3dB frequency? **(1 mark)**

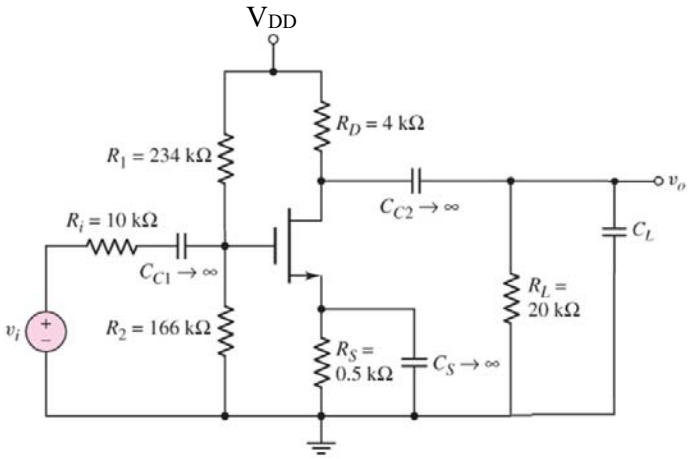


Fig. 3

Q.4 [20 marks]

(a) The circuit diagram of a Wildar current source is shown in **Fig. 4(a)**. Design the circuit such that I_o = 20μA and I_{REF} = 100μA neglecting the base current. Also determine the V_{BE2}. [Given that V^+ = 3.3 V, V^- = -3.3 V, V_{BE1} = 0.7 V and $V_A = \infty$] **(10 marks)**

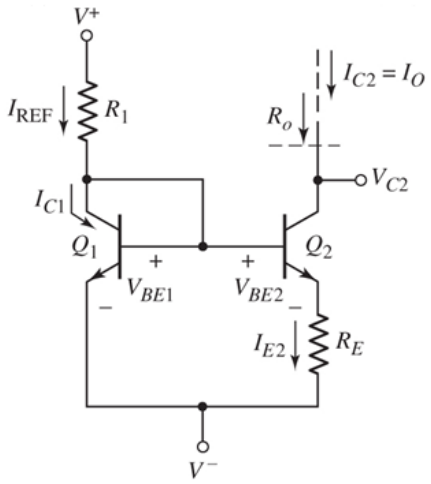


Fig. 4(a)

(b) Define feedback amplifier and describe its advantages and disadvantages of the negative feedback amplifier. **(5 marks)**

(c) The open-loop low-frequency gain of a series shunt amplifier is $A_v = 5\times10^4$ and the open loop 3 dB frequency is f_H = 10 kH. If the closed-loop gain is A_{vf} = 25, what is the closed loop bandwidth? If the open-loop amplifier R_i = 10 KΩ and R_o = 100 Ω, what is the value of input resistance, R_{if} and output resistance R_{of} of the feedback amplifier? **(5 marks)**

Q.5 [20 marks]

(a) The ideal feedback amplifier topology is shown **Fig. 5(a)**. Identify the type of feedback and derive step by step the closed loop gain, A_{gf}, the input resistance, R_{if} and output resistance R_{of}. **(10 marks)**

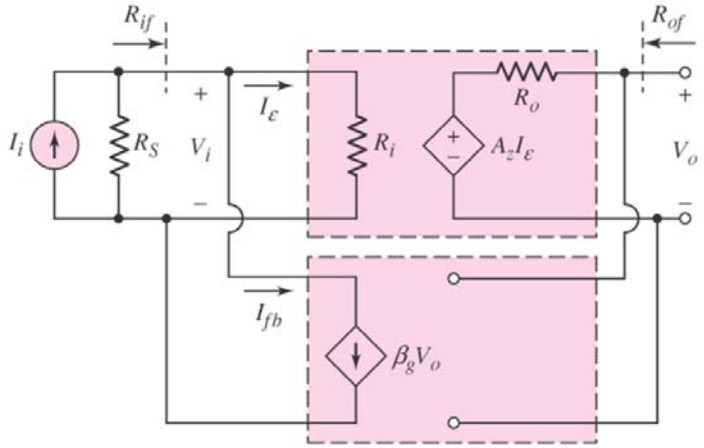


Fig. 5(a)

(b) Derive step by step the DC transfer characteristic equations (i_c as a function of v_d) for the differential amplifier shown in **Fig. 5(b)** and draw the transfer characteristics curve (i_c versus v_d)

(10 marks)

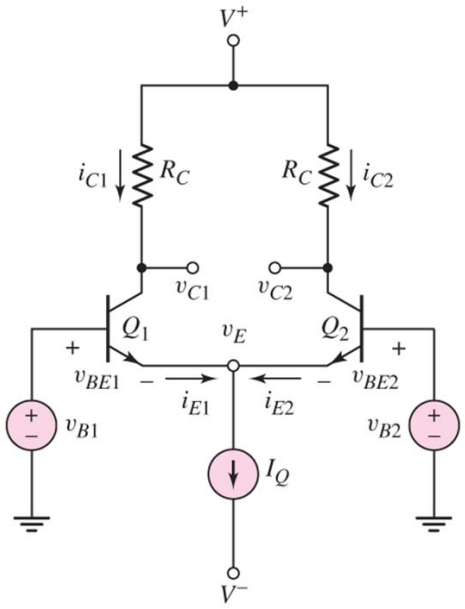


Fig. 5(b)

USEFUL FORMULA

BJT	MOSFET
$i_C = I_S e^{v_{BE}/V_T} \cdot \left(1 + \frac{v_{CE}}{V_A}\right)$ $g_m = \frac{I_{CQ}}{V_T}$ $r_\pi = \frac{\beta V_T}{I_{CQ}}$ $r_o = \frac{V_A}{I_{CQ}}$ $V_T = 26\,\text{mV}$ $V_{BE}(on) = 0.7\text{V}$	$I_D = \frac{1}{2} k_n' \left(W/L\right)(V_{GS} - V_T)^2 (1 + \lambda V_{DS})$ $g_m = 2\sqrt{K_n I_{DQ}}$ $r_o = \frac{1}{\lambda I_{DQ}}$ $K_n = \frac{k_n'}{2}\left(\frac{W}{L}\right)$