UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2012/2013

COURSE NAME	:	ANALOG ELECTRONICS/ ELECTRONIC PRINCIPLES
COURSE CODE	:	BEL 10203/ BEE 2113/ BEX 20603
PROGRAMME	:	BEB/ BEH/ BED/ BEU/BEE
EXAMINATION DATE	:	JUNE 2013
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **EIGHT (8)** PAGES

Q1 (a) (i) Diode is a structure constructed from extrinsic semiconductor materials. Name the two types of extrinsic semiconductor materials used in constructing the diode.

(1 mark)

(ii) Explain briefly the action that takes place when the two materials in part **Q1(a)(i)** are put closely to each other.

(4 marks)

(b) A bridge rectifier circuit in **Figure Q1(b)** is connected to a step down transformer with the turns ratio of 5:1. Sketch and label the input voltage, V_{in} and output voltage, V_o of the rectifier. Assume the diodes are Silicon.

(5 marks)

(c) The circuit in **Figure Q1(c)** is used to drive an electrical appliance, represented by a load, R_L. For the zener diode, its breakdown voltage is 8.2 V. The voltage of unregulated power supply, V_U is 15 V.

(i) Calculate the current across zener diode, I_Z.

(3 marks)

(ii) Calculate the zener power, P_Z and power dissipation of R_S, P_{R_S}.

(2 marks)

(iii) Find the no load zener power, $P_{Z(NL)}$

(2 marks)

(iv) In order to protect the zener diode used in this regulator, the full-load zener current is set to be 5 times of its knee current. If its knee current is 1 mA, determine the minimum recommended load resistance.

(3 marks)

Q2 (a) (i) By using the characteristics of **Figure Q2(a)**, find all resistors values for the common emitter BJT amplifier circuit using voltage divider bias configuration for *npn* silicon. The voltage at the emitter of the transistor (V_E) is to be one fifth of the supply voltage. Assume $\beta R_E \geq 10R_2$.

(10 marks)

(ii) Hence, construct the circuit having a bypass capacitor, C_E configuration.

(2 marks)

(b) (i) If a 1 kΩ resistor is connected at the output as a load, R_L, draw the AC equivalent circuit and determine the input and output impedances, Z_i and Z_o.

(6 marks)

(ii) Hence, show that the loaded voltage gain, $A_{V(WL)}$ may written as (assuming the transistor AC output resistance $r_o = \infty$):

$$A_{V(WL)} = \frac{V_O}{V_i} \approx -\frac{R_C // R_L}{r_e}$$

Evaluate this expression.

(2 marks)

Q3 (a) Name two parameters of an E-MOSFET that are not specified for D-MOSFETs.

(2 marks)

(b) For the *n*-channel D-MOSFET in **Figure Q3(b)**, the $I_{DSS} = 20$ mA, $V_p = -2$ V *and* $y_{os} = 10$ μS:

(i) find the quiescent values, I_{DQ} and V_{GSQ} by using the graphical method.

(7 marks)

(ii) determine the transconductance, g_m

(2 marks)

(iii) draw the AC equivalent circuit and calculate the input impedance, Z_i, output impedance, Z_o and voltage gain, A_v.

(7 marks)

(iv) if a 10 kΩ resistor is connected at the output as a load, R_L, calculate the voltage gain with load, $A_{v(WL)}$.

(2 marks)

Q4 (a) **Figure Q4(a)** 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):

(i) calculate the mid-band gain of this amplifier.

(4 marks)

(ii) draw the low frequency AC equivalent circuit and determine the dominant low cut-off frequency.

(7 marks)

(iii) draw the high frequency AC equivalent circuit and determine the dominant high cut-off frequency.

(6 marks)

(iv) Sketch the normalised magnitude response of this filter. Clearly indicate the break frequencies and bandwidth in the diagram.

(3 marks)

Q5 (a) For the basic Class B push pull amplifier in **Figure Q5(a)**:

(i) state the condition of upper and lower transistor

(1 mark)

(ii) calculate the current, I and V_o and sketch the input and output voltage waveform. State clearly any assumption made in your calculations.

(5 marks)

(iii) calculate the efficiency, η

(4 marks)

(iv) determine the power dissipated by each transistor, P_Q.

(2 marks)

(b) Compute the values of R_C, R_E and V_{CC} of a basic differential amplifier in **Figure Q5(b)** so that it can produces a differential gain, A_d of 127, with an I_{CQ} = 1.3 mA. Assume $V_{CE} = ½V_{CC}$.

(8 marks)

- END OF QUESTION -

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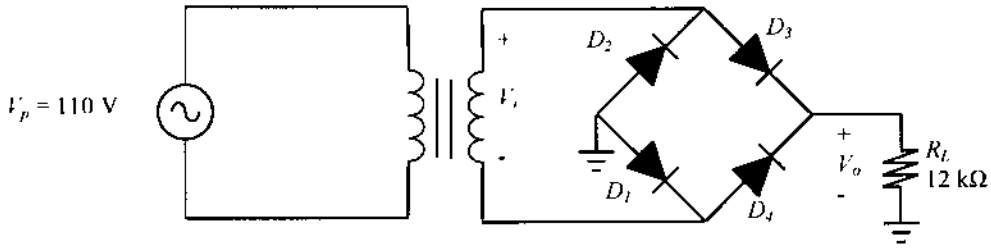

FIGURE Q1(b)

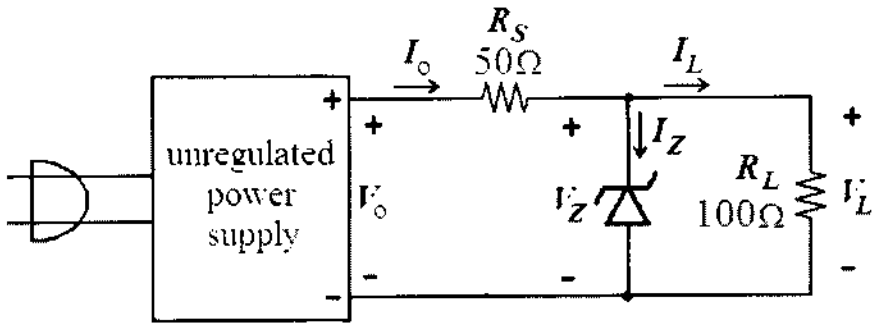

FIGURE Q1(c)

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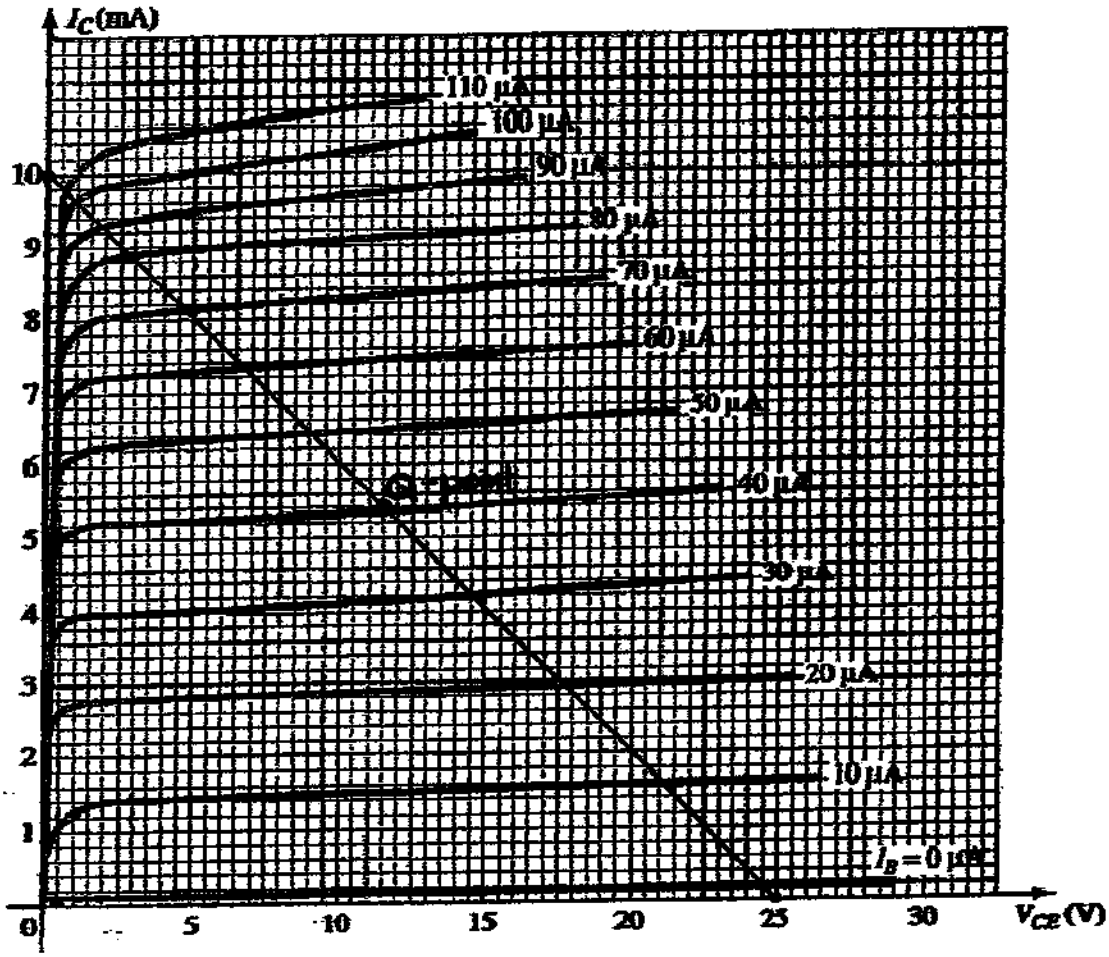

FIGURE Q2(a)

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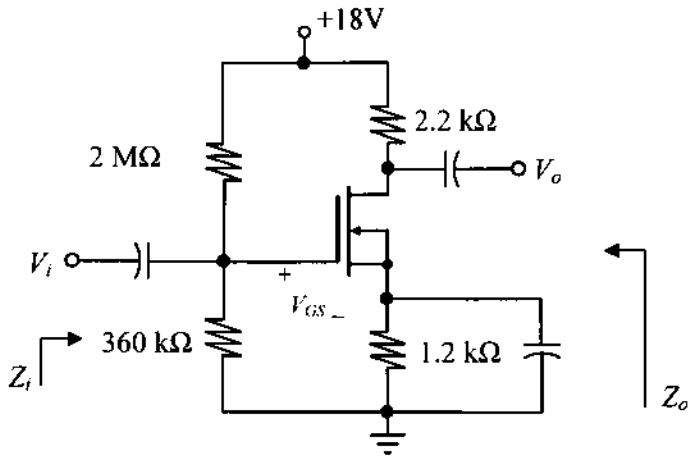

FIGURE Q3(b)

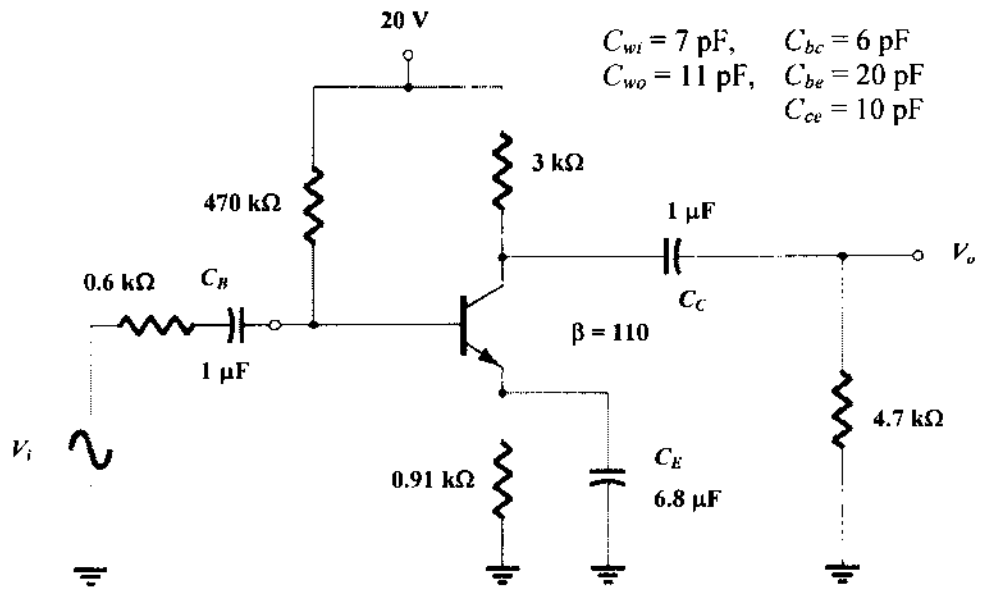

FIGURE Q4(a)

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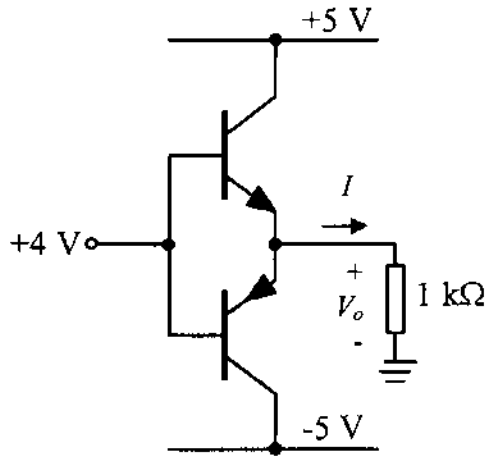

FIGURE Q5(a)

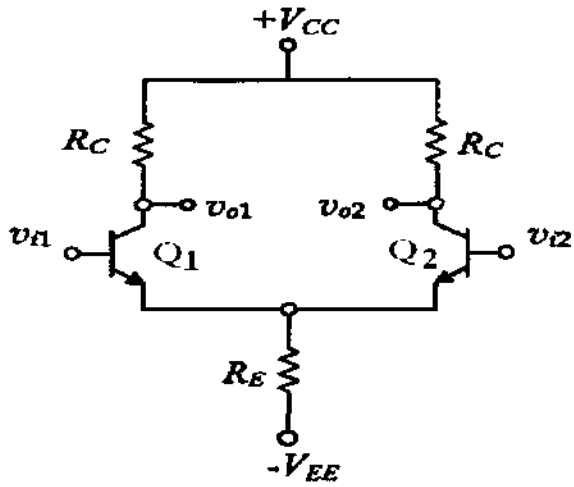

FIGURE Q5(b)