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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER 2
SESSION 2017/2018**

COURSE NAME : ANALOG ELECTRONICS
COURSE CODE : BEL 10203
PROGRAMME : BEJ/BEV
EXAMINATION DATE : JUNE/JULY 2018
DURATION : 3 HOURS
INSTRUCTION : ANSWER ALL QUESTIONS

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THIS QUESTION PAPER CONSISTS OF SIX (6) PAGES

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- Q1** (a) Boron (B) is an example of impurity atom that added to an intrinsic semiconductor to produce an extrinsic semiconductor. By using a suitable diagram, describe the doping process and the type of material produced by this process. (4 marks)
- (b) State the differences between Forward-biased and Reversed-biased a PN junction. (2 marks)
- (c) By using a table, distinguish between a normal diode and Zener diode. (4 marks)
- (d) **Figure Q1(d)** shows a diode circuit. Assume a Silicone diode is used, determine the following.
- (i) Thevenin equivalent circuit as seen from terminal a-b. (4 marks)
 - (ii) Current I_D . (2 marks)
 - (iii) Power dissipated by $300\ \Omega$ resistor. (2 marks)

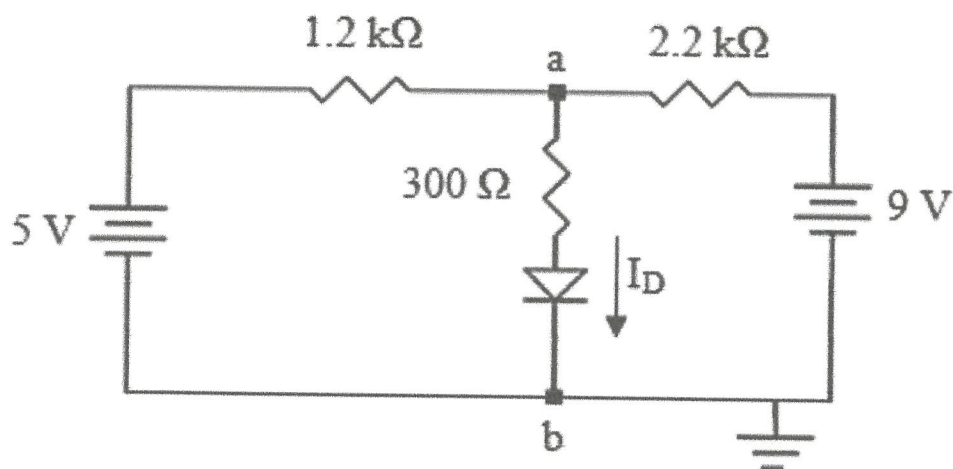


Figure Q1(d)

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- (e) Design a 15 V Zener diode voltage regulator from a poorly regulated 25 V source. The desired output operation comes with 15 mA nominal load and source current of 30 mA.
- (i) Draw the circuit. (1 marks)
 - (ii) Calculate the values of both limiting resistor (R_S) and load resistor (R_L) used in the design. (4 marks)
 - (iii) Calculate power dissipated in the Zener diode. (2 marks)

- Q2** (a) List 4 advantages of Bipolar junction transistor (BJT). (4 marks)
- (b) By using a table, summarize the BJT operating region and biasing condition at both Collector-Base (CB) and Base-Emitter (BE) junction. (3 marks)
- (c) The Emitter Stabilized bias circuit shown in **Figure Q2(c)** has the following specifications; $I_{C_{sat}} = 4.4 \text{ mA}$, $I_{CQ} = I_{C_{sat}}/2$, $V_{CEQ} = 10 \text{ V}$, $\beta = 90$, $V_{CC} = 24 \text{ V}$, $V_E = V_{CC}/10$, $C_1 = 10\mu\text{F}$, $C_2 = 10\mu\text{F}$
- (i) Determine the values for R_E , R_C and R_B . (6 marks)
 - (ii) Draw the AC equivalent circuit for circuit in **Figure Q2(c)**. (3 marks)
 - (iii) Suppose the value of r_o is very large ($r_o = \infty$), compute the values for input impedance (Z_i), output impedance (Z_o) and voltage gain (A_v). (9 marks)

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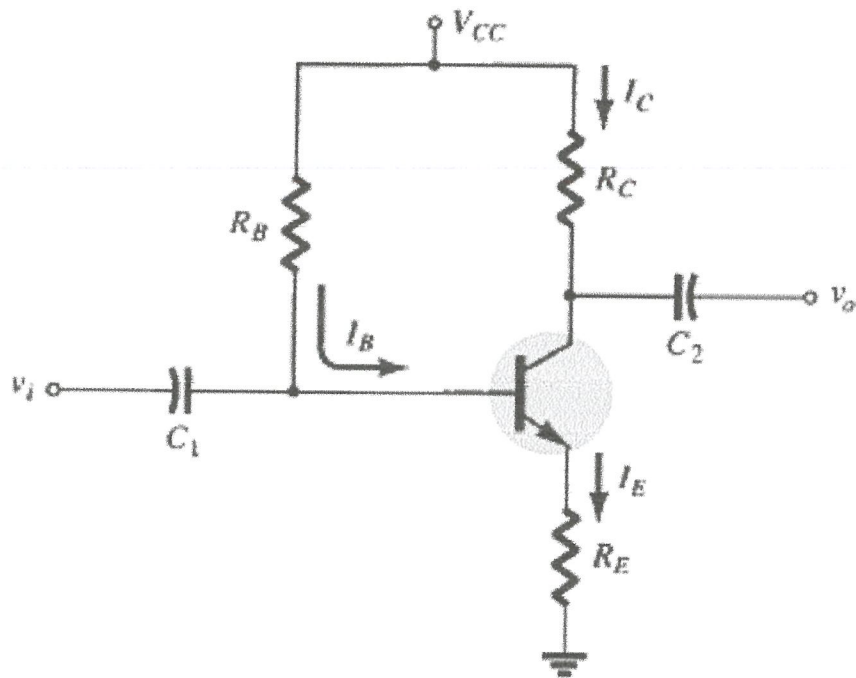


Figure Q2(c)

- Q3** (a) Explain the structure of n-channel Enhancement MOSFET (E-MOSFET). (3 marks)
- (b) Shockley equation defined the relationship between input voltage (V_{GS}) and output current (I_D) of a Junction Field Effect Transistor (JFET). Consider the circuit shown in **Figure Q3(b)**.
- (i) Plot the resultant transfer characteristic curve by using Shockley equations. (6 marks)
- (ii) Determine the Q-point (V_{GSQ} , I_{DQ}) on the curve drawn in part Q3(b)(i). (8 marks)
- (iii) By using the Q-point value obtained in part Q3(b)(ii), calculate V_D , V_S , V_{DS} and V_{DG} . (8 marks)

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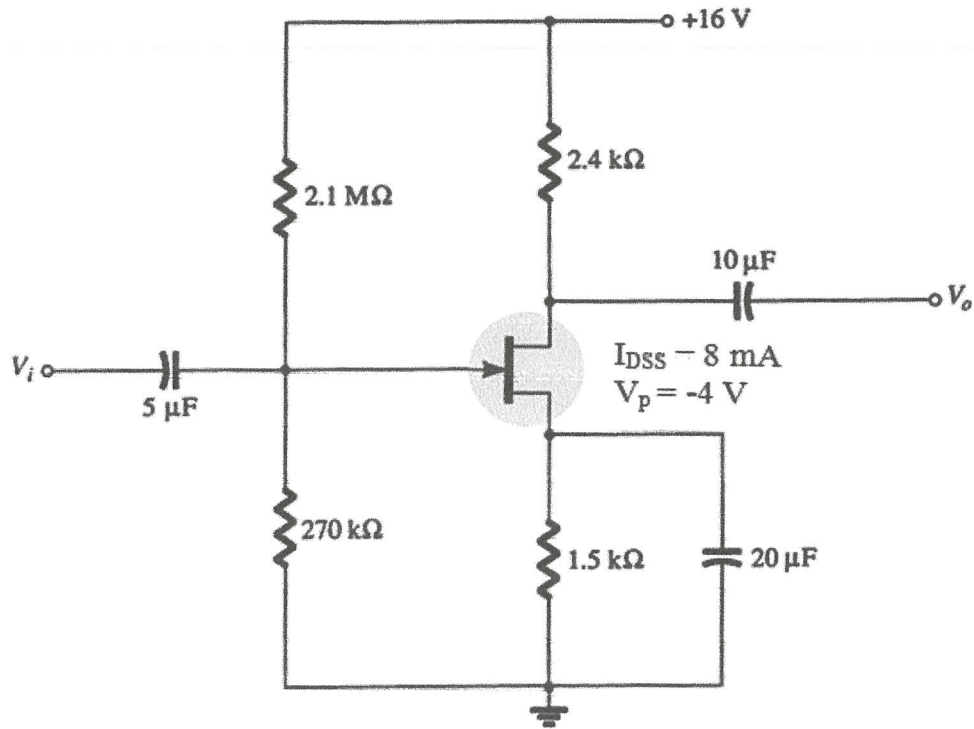


Figure Q3(b)

- Q4 (a) Bode Plot represents frequency response of an amplifier. Sketch a Bode plot and label all important points accordingly. (5 marks)
- (b) Compare the effect of capacitors and inductors (if any) on the gain at low, high and mid-band frequencies. (3 marks)
- (c) Miller effect capacitance is dependent on inter-electrode capacitance from input to output and the gain.
- (i) Justify the circuit configuration that caused this capacitance effect becomes noticeable in both BJT as well as FET. (4 marks)
 - (ii) By using suitable block diagram and equation, distinguish Miller Input Capacitance (C_{Mi}) and Miller Output Capacitance (C_{Mo}). (6 marks)

- (d) Explain the operation of a Class AB amplifier and how it eliminates the crossover distortion.

(7 marks)

- END OF QUESTIONS -

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