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SET A

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION

JANUARY 2014 SESSION

SUBJECT CODE	:	**NMB 20102**
SUBJECT TITLE	:	**ELECTRONICS ENGINEERING**
LEVEL	:	**BACHELOR**
TIME / DURATION	:	**2.5 HOURS**
DATE	:	

INSTRUCTIONS TO CANDIDATES

1. **Please read the instructions given in the question paper CAREFULLY.**
2. **This question paper is printed on both sides of the paper.**
3. **Please write your answers on the answer booklet provided.**
4. **Answer should be written in blue or black ink except for sketching, graphic and illustration.**
5. **This question paper consists of TWO (2) sections. Section A and B. Answer all questions in Section A. For Section B, answer TWO (2) question only.**
6. **Answer all questions in English.**
7. **Do not open the question paper until instructed to do so.**

THERE ARE 8 PAGES OF QUESTIONS AND 1 PAGE OF APPENDIX, EXCLUDING THIS PAGE.

SECTION A (Total: 40 marks)

INSTRUCTION: Answer ALL questions.
Please use the answer booklet provided.

Question 1

The electrical behavior of diode can be described with ideal and practical models. Draw both models.

(4 marks)

Question 2

The circuit shown on **Figure 1** is a zener diode voltage regulator. If V_S = 10 V, R_2 = 100 Ω, V_Z = 6 V, I_{ZK} = 1 mA, find the minimum value of R_1 so that the zener diode stays in the breakdown region.

(10 marks)

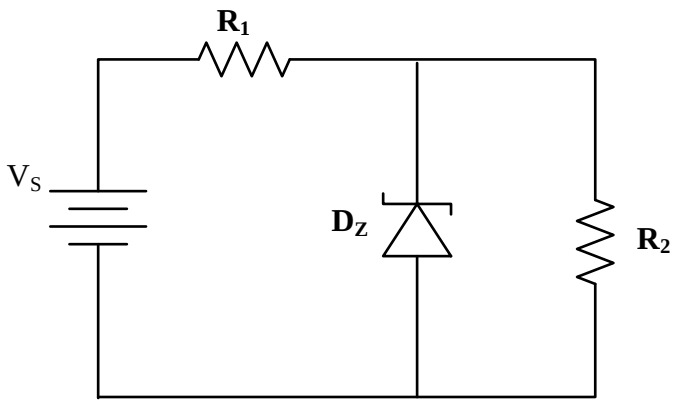


Figure 1

Question 3

Determine the beta rating for the BJT shown in **Figure 2**. Then determine the value of I_C using both the alpha rating and the beta rating of the BJT.

(6 marks)

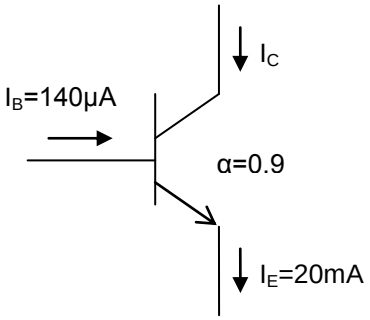


Figure 2

Question 4

(a) Convert the following binary numbers to decimal.

(i) 10010001

(4 marks)

(ii) 10111101.011

(6 marks)

(b) Draw the logic circuit that implements the expression

$$x = \bar{A}.B.C(\overline{A+D})$$

(10 marks)

SECTION B (Total: 60 marks)

INSTRUCTION: Answer only TWO (2) questions.

Please use the answer booklet provided.

Question 5

(a) Suppose the zener diode in **Figure 3** has a breakdown voltage of 10 V. Calculate the minimum and maximum zener currents.

(8 marks)

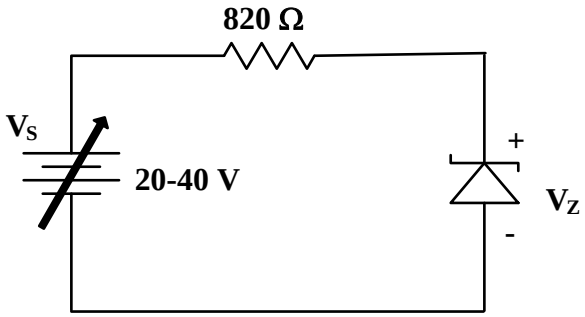


Figure 3

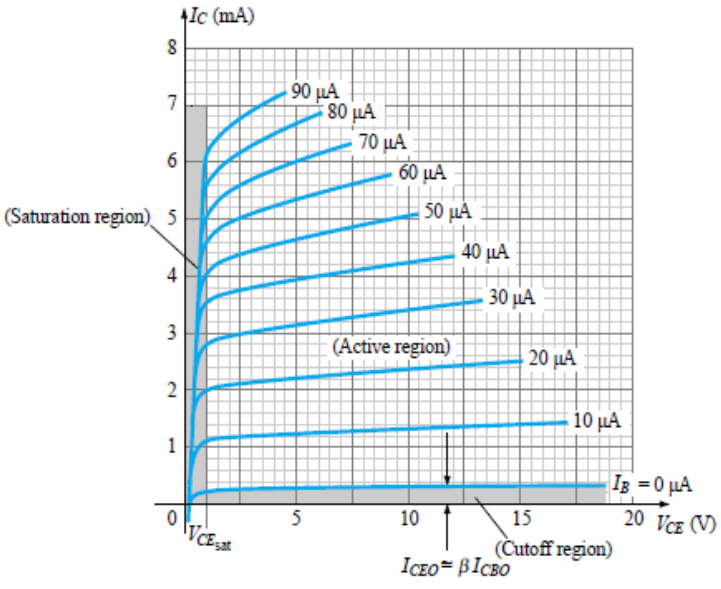
(b) Using the characteristics in **Figure 4**, determine:

(i.) The value of I_C corresponding to V_{BE} = +0.75 V and V_{CE} = +5 V.

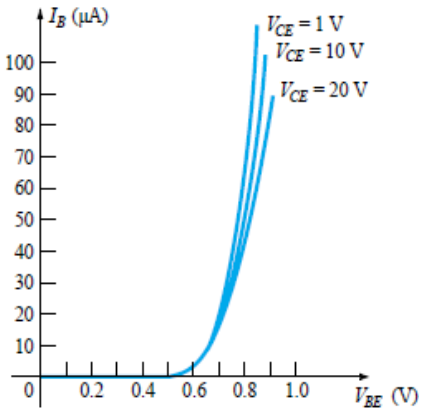
(4 marks)

(ii.) The value of V_{CE} and V_{BE} corresponding to I_C = 3 mA and I_B = 30 µA.

(6 marks)



(a)



(b)

Figure 4

(c) Answer the following questions:

(i) Convert the following decimal numbers (58, 125 and 19) into the binary numbering system.

(6 marks)

(ii) Digital circuit in **Figure 5** shows the combinational logic circuit with three inputs and one output. Give the Boolean algebra for **S**, **X** and **Y**.

(6 marks)

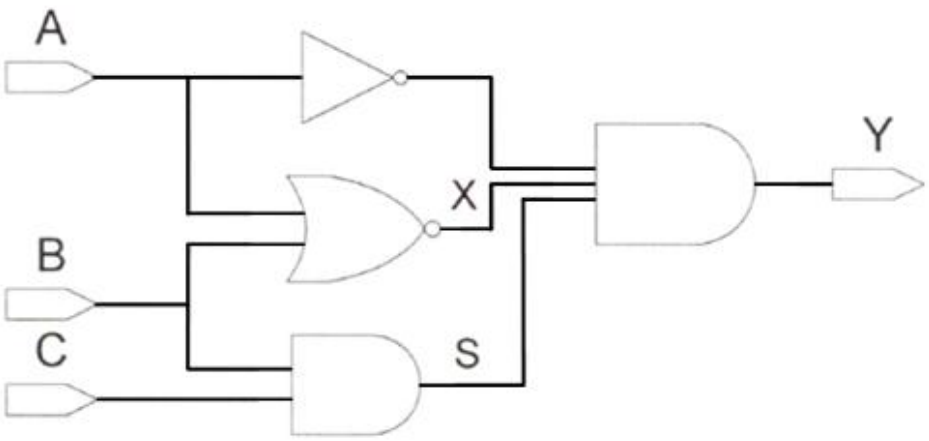


Figure 5

Question 6

(a) The zener diode circuit in **Figure 6** has zener voltage of 9 V. Given that V_S = 27 V, R_S = 15 kΩ, and R_L = 10 kΩ. Assuming that the zener diode is operating in the breakdown region, calculate the current I_S, I_L, and I_Z shown in the circuit.

(6 marks)

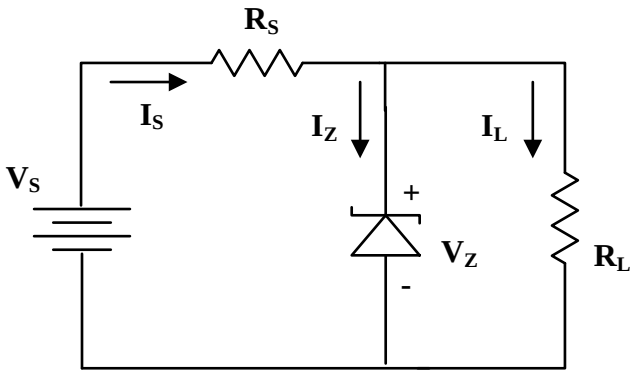


Figure 9

(b) A water height sensor module in **Figure 7** uses a silicon based bipolar junction transistor to energize and operate a $12V_{DC}$ relay. The operation of the circuit is as follows: When sensor detects water, switch is closed and the BJT shall turn 'ON'. The relay then will be energized. Given β = 100, determine I_B, I_C, I_E, V_{BE}, V_{CE} and V_{CB}.

(12 marks)

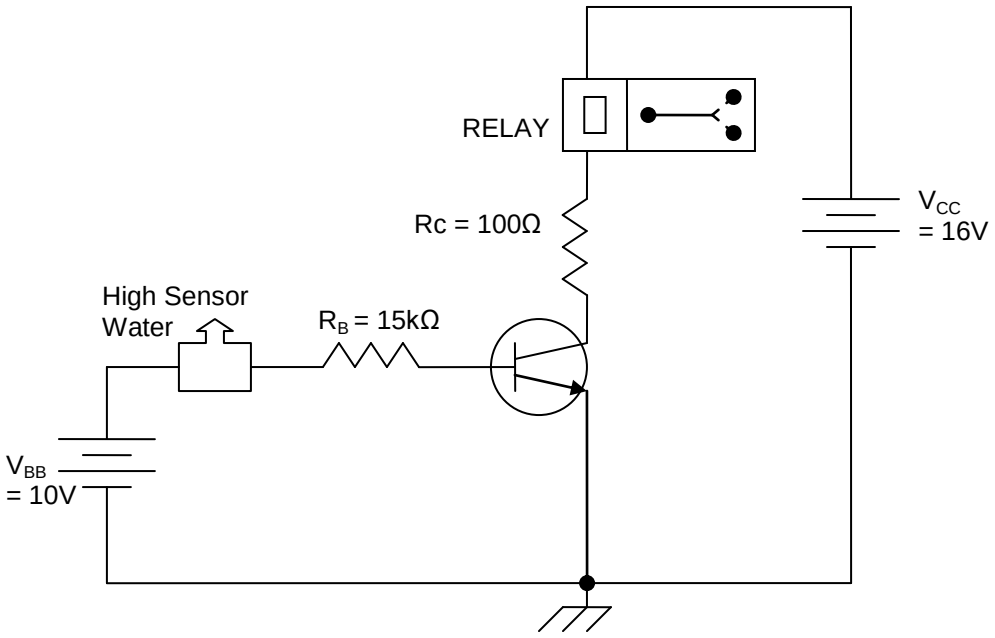


Figure 7

(c) Answer the following questions:

(i) Determine the binary numbers for the following hexadecimal numbers:

- $10A4_{16}$
- $CF8E_{I6}$

(6 marks)

(ii) Design the logic circuit that has three inputs A, B and C, and whose output will be HIGH only when a majority of the inputs are HIGH. The design should include the truth table and Boolean expression and circuit diagram.

(6 marks)

Question 7

(a) Consider the half wave rectifier circuit in **Figure 8**.

(i) Draw the resultant output voltage for the circuit.

(3 marks)

(ii) Derive the expression for DC voltage output if $V_1 = V_M \cdot \sin\theta$ where V_M is the peak voltage and θ is the electrical angle.

(5 marks)

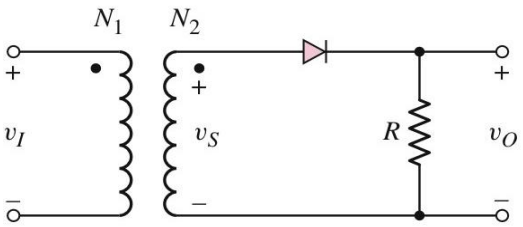


Figure 8

(b) (i) Given the information in **Figure 9**, determine I_C, V_{CC}, β, and R_B. Consider germanium based BJT.

(8 marks)

(ii) Find the saturation current I_{Csat} for the same circuit configuration.

(4 marks)

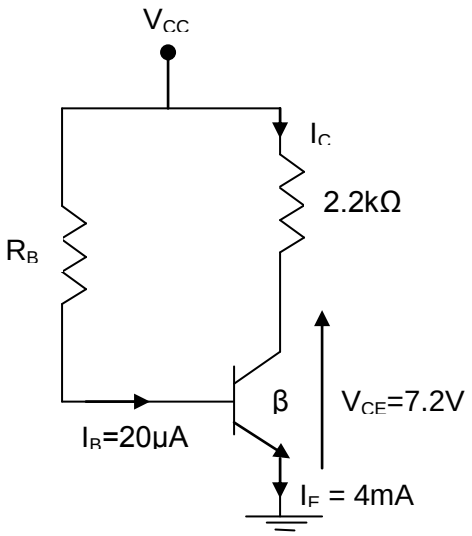


Figure 9

(c) Answer the following questions:

(i) Convert the following hexadecimal number to binary:

- 38_{16}
- 59_{16}
- $A14_{16}$
- $5C8_{16}$

(4 marks)

(ii) Simplify the circuit diagram in **Figure 10** using demorgan theorem or oolean equation.

(6 marks)

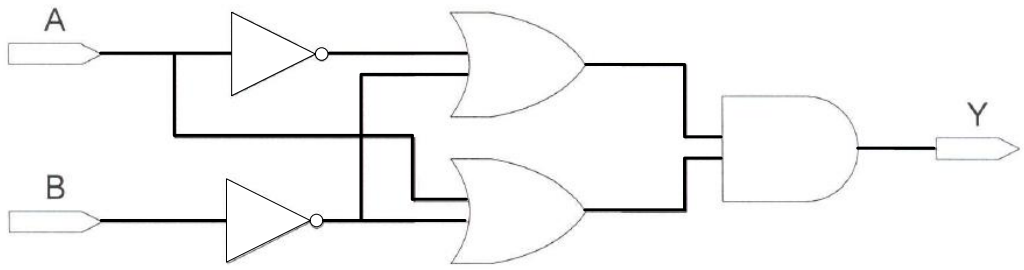


Figure 10

END OF QUESTION PAPER

APPENDIX 1

BOOLEAN THEOREMS

1. $X \bullet 0 = 0$
2. $X \bullet 1 = X$
3. $X \bullet X = X$
4. $X \bullet \overline{X} = 0$
5. $X + 0 = X$
6. $X + 1 = 1$
7. $X + X = X$
8. $X + \overline{X} = 1$
9. $X + Y = Y + X$
10. $X \bullet Y = Y \bullet X$
11. $X + (Y + Z) = (X + Y) + Z = X + Y + Z$
12. $X(YZ) = (XY)Z = XYZ$

13*a*. $X(Y + Z) = XY + XZ$

13*b*. $(W + X)(Y + Z) = WY + XY + WZ + XZ$

14. $X + XY = X$
15. $X + \overline{X}Y = X + Y$
16. $\overline{X + Y} = \overline{X}\,\overline{Y}$
17. $\overline{XY} = \overline{X} + \overline{Y}$
18. $\overline{\overline{A}} = A$