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CONFIDENTIAL

SET A

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION

JANUARY 2014 SESSION

SUBJECT CODE	:	**FLD 10103**
SUBJECT TITLE	:	**ANALOG ELECTRONICS**
LEVEL	:	**DIPLOMA**
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. **Answers 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) questions only.**
6. **Answer all questions in English.**

THERE ARE 7 PAGES OF QUESTIONS, EXCLUDING THIS PAGE AND APPENDIX.

SECTION A (Total: 60 marks)

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

Question 1

(a) Draw an ideal and practical pn-junction diode characteristic curve.

(4 marks)

(b) By assuming silicon diode, determine the value of I_T for the circuit shown in **Figure 1** using the:

(i) Ideal diode model.
(ii) Practical diode model.

(6 marks)

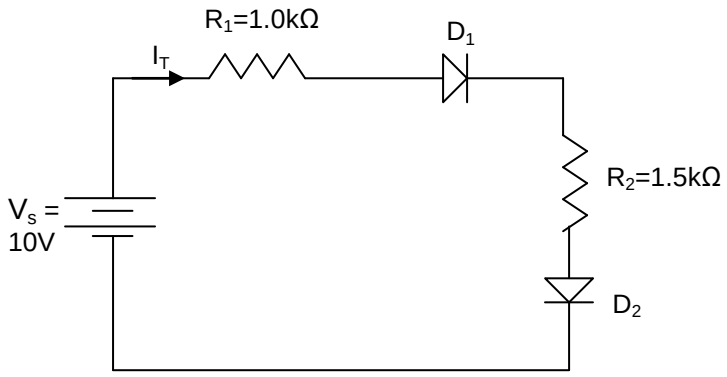


Figure 1

(c) List out two (2) applications for a zener diode.

(2 marks)

(d) The IN757A zener diode has a dc power dissipation rating of 500mW and a nominal zener voltage of 6.8V. Determine the value of I_{ZM} for the device.

(3 marks)

(e) Determine the alpha rating for the transistor shown in **Figure 2**. Then determine the value of I_C using both the alpha and the beta ratings of the transistor.

(5 marks)

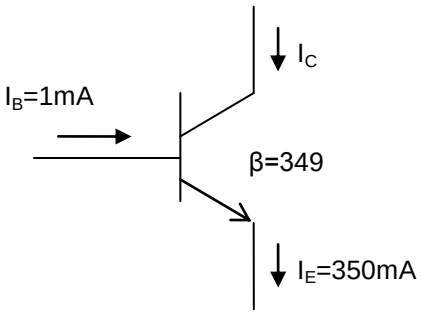


Figure 2

Question 2

(a) Give 2 advantages of bridge rectifier compared to other rectifier circuits.

(2 marks)

(b) A positive full-wave bridge rectifier is fed by a $20V_{ac}$ transformer with the load of 10kΩ. (Diodes are silicon type).

(i) Draw the positive full-wave bridge rectifier circuit and explain the operation of the circuit.

(6 marks)

(ii) Sketch the waveform of transformer's secondary voltage, V_2 and the load voltage, V_L.

(4 marks)

(iii) Calculate the value of peak load voltage (V_{Lp}), average load voltage (V_{Lavg}) and average load current (I_{Lavg}).

(8 marks)

Question 3

Figure 3 shows a clipper circuit using two ideal silicon zener diodes with its respected output voltage, V_{OUT}. For both question (a) and (b), please refer to data sheet attached in **Appendix** and determine:

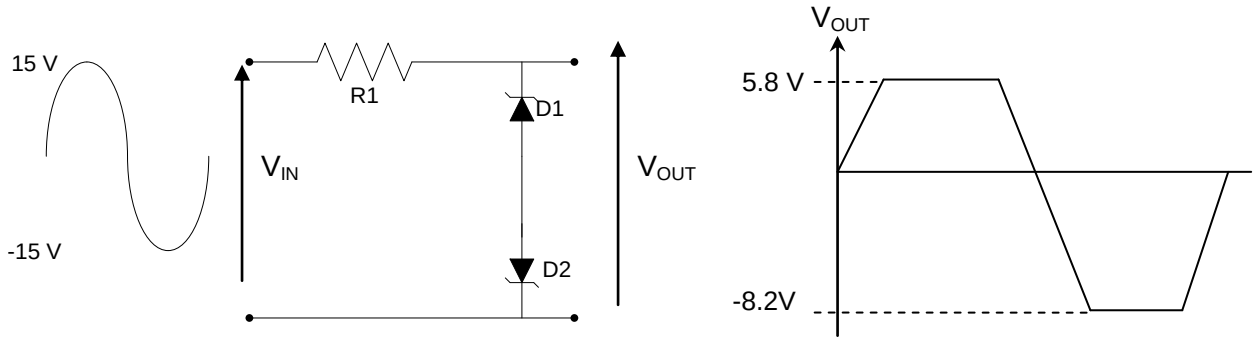


Figure 3

(a) The device type number of zener diode D_1 and D_2. Support your answer with calculation.

(12 marks)

(b) Each of the following parameters value and unit for answer in (a).

(i) maximum DC Power Dissipation ($\mathbf{P_D}$) (2 marks)

(ii) nominal Zener Voltage ($\mathbf{V_Z}$) (2 marks)

(iii) zener Knee Current ($\mathbf{I_{ZK}}$) (2 marks)

(iv) maximum Zener Impedance at Test current ($\mathbf{Z_Z}$) (2 marks)

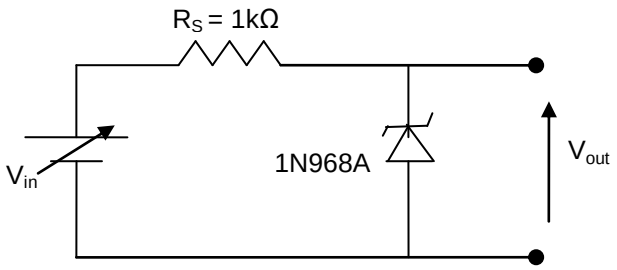
SECTION B (Total: 40 marks)

INSTRUCTION: Answer TWO (2) questions only.

Question 4

By considering ideal zener diode, determine the minimum and maximum input voltages that can be regulated by the zener diode in **Figure 4** below.

(20 marks)



1N968A Parameters:
V_Z = 20V at I_{ZT} = 20mA
I_{ZK} = 0.2mA
P_D = 1W at T_L = 50˚C

Figure 4

Question 5

(a) Draw I-V characteristic curve of transistor and indicate on the curve all operating regions for transistor.

(5 marks)

(b) A high sensor water module in **Figure 5** below uses a silicon based bipolar junction transistor to make a relay $12V_{dc}$ energize and function. The operation of the circuit is as follows: When sensor detects water, switch is closed and the transistor will 'ON'. The relay then will be energized. Given β = 60, determine I_B, I_C, I_E, V_{BE}, V_{CE} and V_{CB}.

(15 marks)

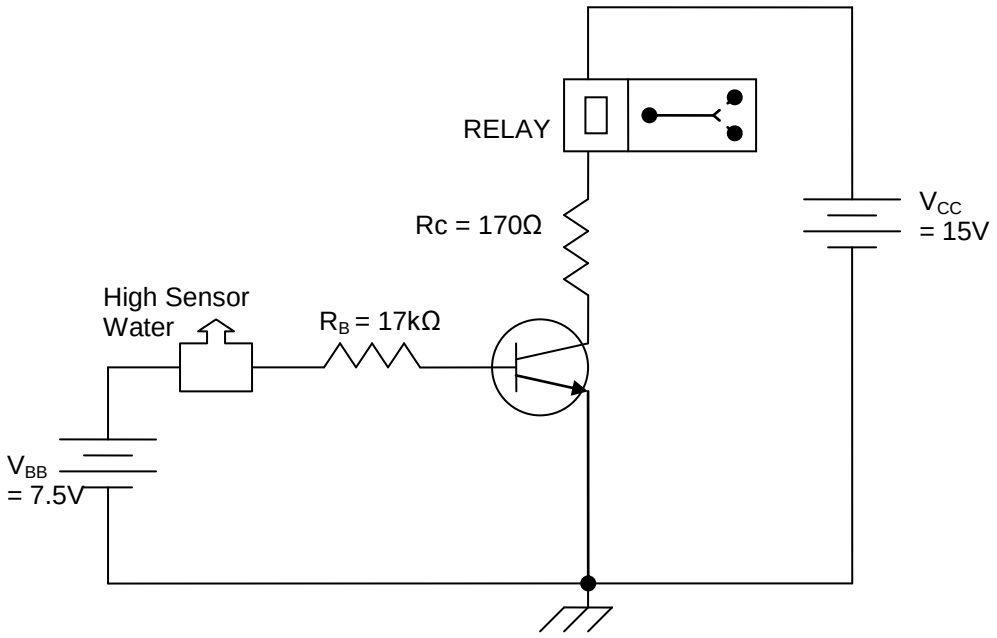


Figure 5

Question 6

(a) (i) Define operational amplifier (op-amp). (3 marks)

(ii) List out the three (3) factors that affect the output of the op-amp. (3 marks)

(ii) List out three (3) types of op-amp's IC packaging. (3 marks)

(b) Refer to **Figure 6** and answer the following questions.

(i) Identify the amplifier. (2 mark)

(ii) Determine the closed-loop gain, A_{CL}. (3 marks)

(iii) Calculate the output voltage, V_{out}. (2 marks)

(iv) Sketch the input voltage, V_{in} and output voltage, V_{out} on the same curve. (4 marks)

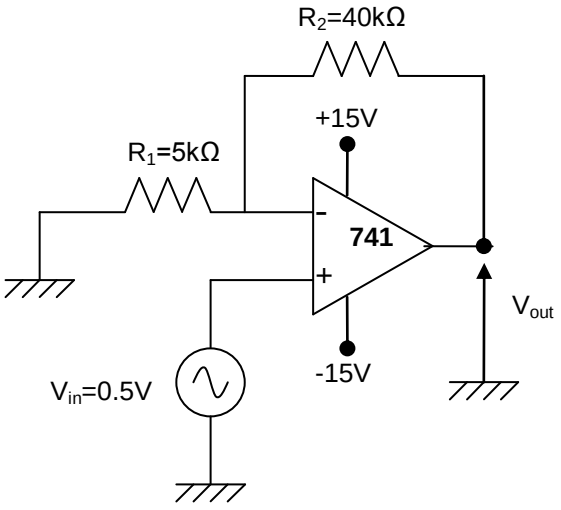


Figure 6

END OF QUESTION PAPER

APPENDIX

FAIRCHILD SEMICONDUCTOR®

January 2005

1N4728A - 1N4764A

Zeners

DO-41 Glass case
COLOR BAND DENOTES CATHODE

Absolute Maximum Ratings *

T_a = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
P_D	Power Dissipation @ TL ≤ 50°C, Lead Length = 3/8"	1.0	W
	Derate above 50°C	6.67	mW/°C
T_J, T_{STG}	Operating and Storage Temperature Range	-65 to +200	°C

* These ratings are limiting values above which the serviceability of the diode may be impaired.

Electrical Characteristics

T_a = 25°C unless otherwise noted

Device	V_Z (V) @ I_Z (Note 1)			Test Current I_Z (mA)	Max. Zener Impedance			Leakage Current	
	Min.	Typ.	Max.		Z_Z @ I_Z (Ω)	Z_{ZK} @ I_{ZK} (Ω)	I_{ZK} (mA)	I_R (μA)	V_R (V)
1N4728A	3.315	3.3	3.465	76	10	400	1	100	1
1N4729A	3.42	3.6	3.78	69	10	400	1	100	1
1N4730A	3.705	3.9	4.095	64	9	400	1	50	1
1N4731A	4.085	4.3	4.515	58	9	400	1	10	1
1N4732A	4.465	4.7	4.935	53	8	500	1	10	1
1N4733A	4.845	5.1	5.355	49	7	550	1	10	1
1N4734A	5.32	5.6	5.88	45	5	600	1	10	2
1N4735A	5.89	6.2	6.51	41	2	700	1	10	3
1N4736A	6.46	6.8	7.14	37	3.5	700	1	10	4
1N4737A	7.125	7.5	7.875	34	4	700	0.5	10	5
1N4738A	7.79	8.2	8.61	31	4.5	700	0.5	10	6
1N4739A	8.645	9.1	9.555	28	5	700	0.5	10	7
1N4740A	9.5	10	10.5	25	7	700	0.25	10	7.6
1N4741A	10.45	11	11.55	23	8	700	0.25	5	8.4
1N4742A	11.4	12	12.6	21	9	700	0.25	5	9.1
1N4743A	12.35	13	13.65	19	10	700	0.25	5	9.9
1N4744A	14.25	15	15.75	17	14	700	0.25	5	11.4
1N4745A	15.2	16	16.8	15.5	16	700	0.25	5	12.2
1N4746A	17.1	18	18.9	14	20	750	0.25	5	13.7
1N4747A	19	20	21	12.5	22	750	0.25	5	15.2