VAVUNIYA CAMPUS OF THE UNIVERSITY OF JAFFNA

First Examination in Information and Communication

Technology - 2016

Second Semester – November / December 2017

ICT 1223 Basic Electronics and Digital Logic Design

Answer Five Questions only

Time: Three hours

Q1. (a) Explain the difference between conductors, insulators and semiconductors on the basis of energy band? [25%]

(b) Differentiate between intrinsic and extrinsic semiconductors? [25%]

(c) Name three acceptor and three donor materials which normally used for doping semiconductors. [20%]

(d) Intrinsic carrier concentration in a semiconductor is 2.1×10^{13} cm $^{-3}$. Find the intrinsic resistivity of the semiconductor. The electron and hole mobilities are $\mu_e = 3900\ \text{cm}^2\ \text{V}^{-1}\ \text{s}^{-1}$ and $\mu_h = 1900\ \text{cm}^2\ \text{V}^{-1}\ \text{s}^{-1}$ respectively. [30%]

Q2. (a) Sketch and explain the forward and reverse characteristic of a p-n junction. [25%]

(b) Discuss briefly about "avalanche breakdown" and "Zener breakdown" in a p - n Junction [25%]

(c) Figure (i) shows a circuit containing resistors of two 100Ω and one silicon diodes. The knee voltage of the silicon diodes is 0.7 V. Find the current through each component in the circuit. [30%]

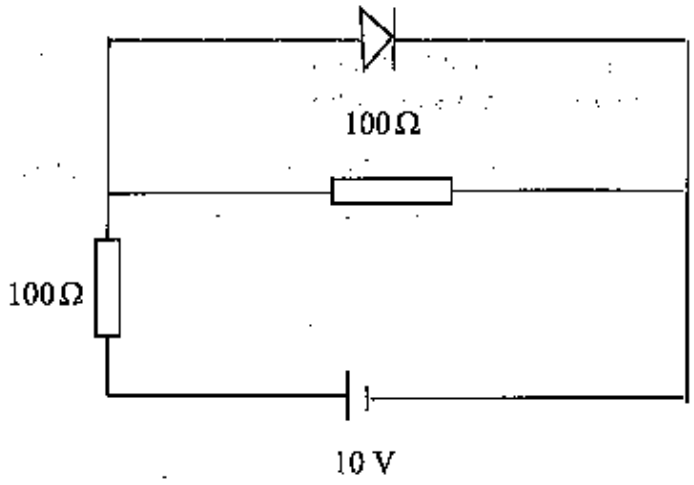


Figure (i)

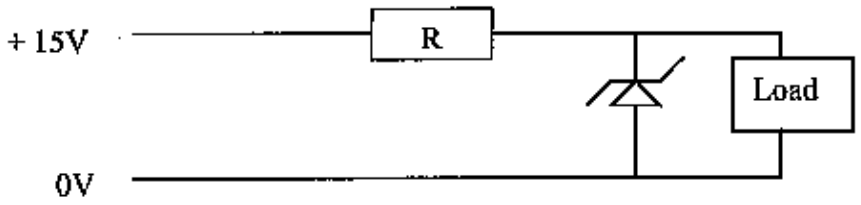
(d) Draw a full – wave bridge rectifier circuit and explain the action briefly. [20%]

Q3. (a) Give three different types of special diodes and explain their applications. [20%]

(b) Sketch and explain the I – V characteristic of a Zener diode. [20%]

(c) Compare normal diode and Zener diode in the followings: doping, Size of the depletion region and action when connected in reverse biased [20%]

(d) Figure shows a regulated voltage supply circuit. The input voltage varies from 10V to 15V. The required output voltage is 7V. The minimum diode current is 10mA and the required load current is 100mA. [40%]



(A) Calculate the followings when the input voltage is 10V

(i) Calculate the voltage across R.
(ii) Find the ideal value of the resistor R.

(B) Calculate the current passing through Zener diode when the input voltage is increased to 15V while using the above calculated value for R.

Q4. (a) Explain the Transfer characteristics of a transistor in common emitter configuration. (Using I_c Vs I_B curve) [20%]

(b) What do you mean by transistor biasing? Hence explain how transistor should be biased in the following circuits.

(i) Transistor as an amplifier

(ii) Transistor as a switch [30%]

(c) The circuit shown in figure (ii) is designed such that the base current is 20 times smaller than the current through the voltage divider. Find the base current, the emitter current I_E and collector – emitter voltage V_{CE} for the circuit. [50%]

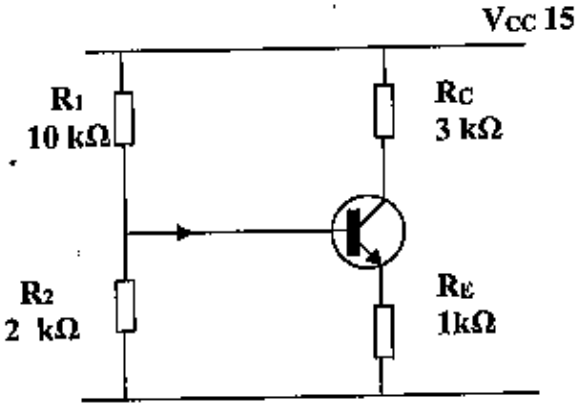


Figure (ii)

Q5. (a) List the advantages of using integrated circuits (ICs) compared to discrete circuits. [20%]

(b) Show that the "closed loop gain" A and "open – loop gain" A_o of an operational amplifier can be related as $A = \frac{A_o}{1+\beta A_o}$ where β is the feedback factor [30%]

(c) Find the closed – loop gain of the inverting amplifier as shown in the figure (iii). [50%]

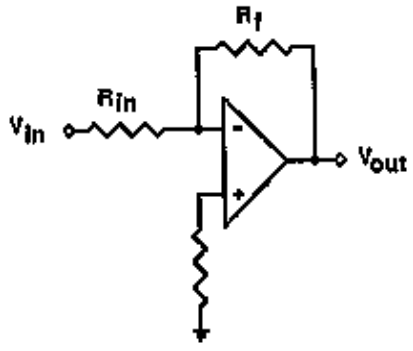
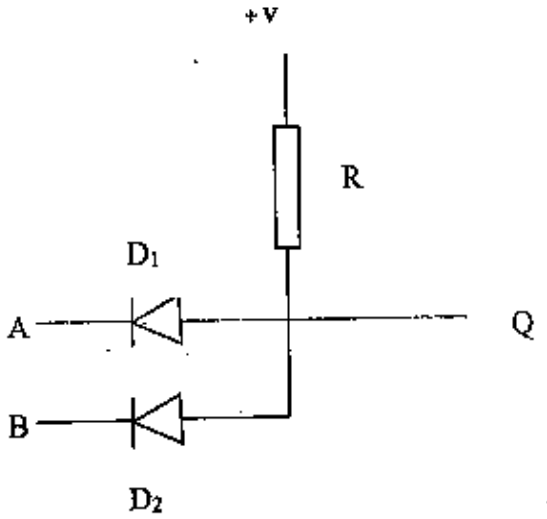


Figure (iii)

Q6. (a) A logic gate circuit diagram is given bellow figure (iv). If A and B are the inputs and Q is the output then complete the truth table.



A	B	Q
0	0	
0	1	
1	0	
1	1	

Figure (iv)

(i) Name the type of the logic gate.

(ii) Draw and label the symbol for this logic gate. [40%]

(b) A multiplexer (or **mux**) shown in figure (v) is a common digital circuit used to mix a lot of signals into just one. Every multiplexer has at least one select line, which is used to select which input signal gets relayed to the output. In a 2-to-1 multiplexer, there's just one select line.

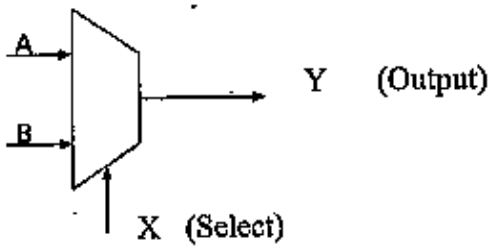


Figure (v)

For example, A and B are the two inputs, X is the select input, and Y is the output. If X is 0 then Y=A and if X is 1 then Y=B.

(i) Compute a Truth Table for a 2-to-1 multiplexer.

(ii) Design the Multiplexer using basic logic gates.

[60%]

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