VAVUNIYA CAMPUS OF THE UNIVERSITY OF JAFFNA

First Examination in Information and Communication

Technology - 2017

Second Semester – March / April 2019

ICT 1223 Basic Electronics and Digital Logic Design

Answer Five Questions only

Time: Three hours

Q1. (a) (i) Explain the difference between conductors, insulators and semiconductors on the basis of energy band? [20%]

(ii) Explain how can the conductivity of a semiconductor be increased? [20%]

(iii) 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 $\mu_e = 3900$ $cm^2 V^{-1} s^{-1}$ and $\mu_h = 1900$ $cm^2 V^{-1} s^{-1}$ respectively. [30%]

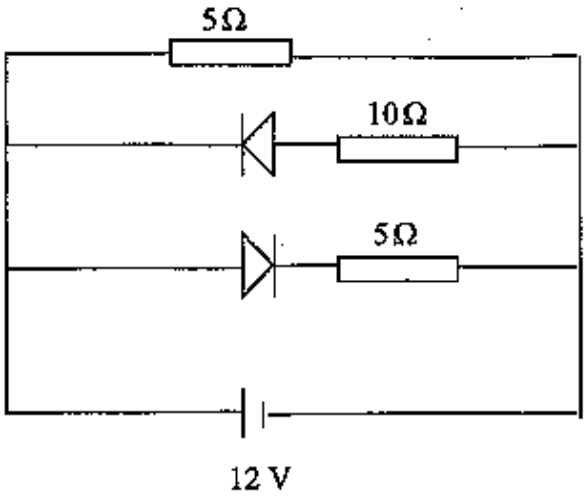
(b) (i) List the advantages of using fiber optic cable compare to copper cable in the communication sector. [15%]

(ii) Name the major electronic devices needed in fiber optic communication and discus briefly how the communication is done. [15%]

Q2. (a) Explain the formation of depletion region and barrier potential of a p–n junction. [30%]

(b) Sketch and explain the forward and reverse characteristic of a p-n junction. [20%]

(c) What currents will flow each of the three branches of the following circuit. The knee voltage of the silicon diodes is 0.7 V. [30%]



(d) Draw a half – wave rectifier circuit and explain the action briefly. Explain the disadvantages in using half – wave rectifier. [20%]

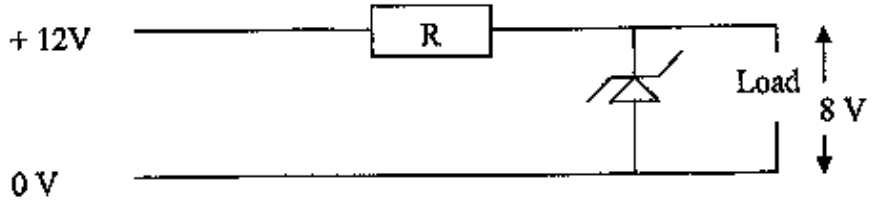
Q3. (a) Give three different types of special diodes and explain their applications. [20%]

(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 zener diode used to produce a stabilized output of 8 V from a nominal 12 V supply. The zener diode must have a minimum current of 10 mA passing through it to maintain its voltage. The current passing through load is 100 mA. [40%]

(i) Calculate the ideal value of *R*. and power dissipated by *R* under these conditions.



(ii) If the output current from this power supply falls to zero while the input voltage is still present, calculate the power dissipated by the zener diode.

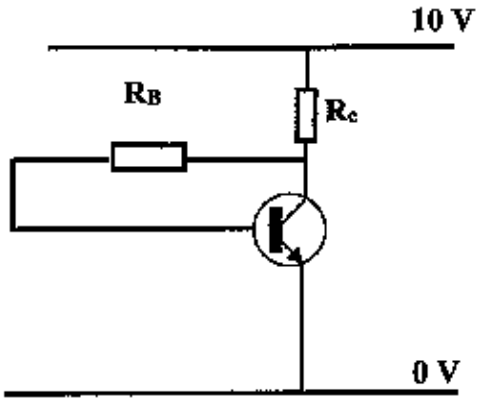
Q4. (a) Explain the Transfer characteristics of a transistor in common emitter configuration. (Using I_c Vs I_B curve) [20%]

(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 following figure shows the collector feedback bias circuit for a Silicon npn transistor. If $R_C = 1k\Omega$, $R_B = 500k\Omega$ and $\beta = 50$, find the collector current. [50%]



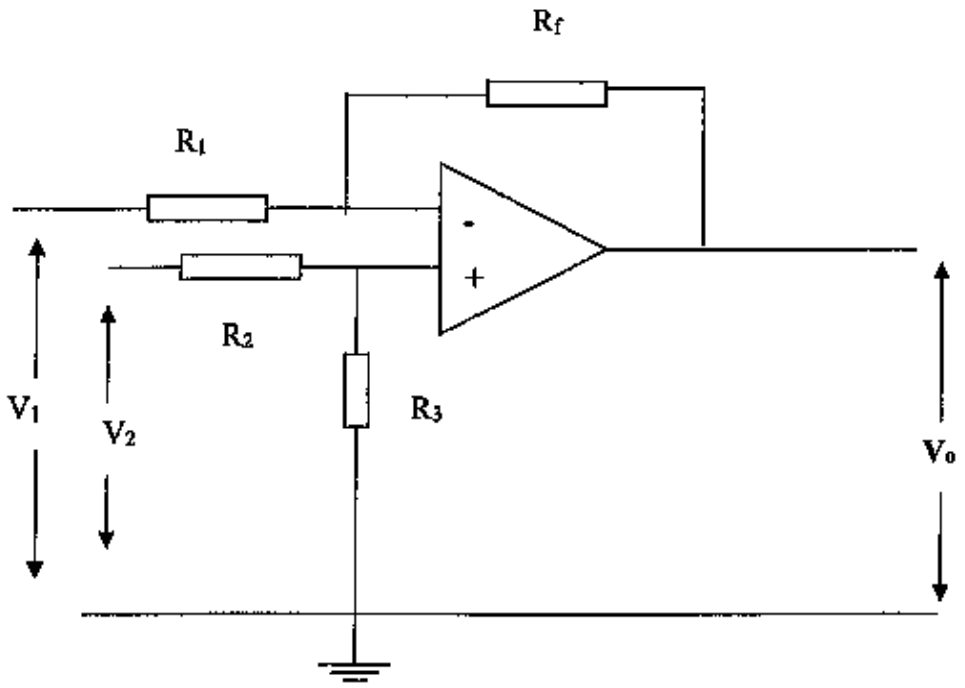
Q5. (a) List the advantages of using integrated circuits (ICs) compared to discrete circuits. [20%]

(b) Write the fundamental properties of operational amplifier. [20%]

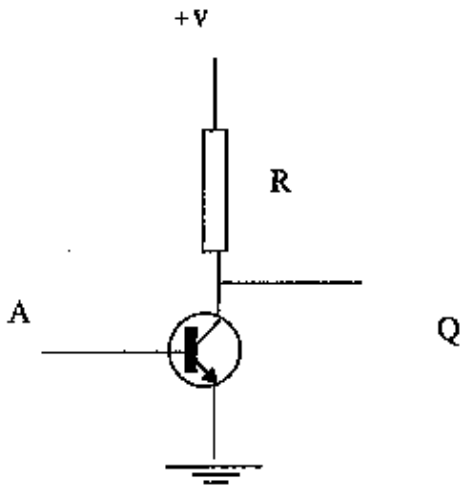
(c) Show that the "closed loop gain" A and "open – loop gain" A_o of an operational amplifier can be related as $A = \dfrac{A_o}{1+\beta A_o}$ where β is the feedback factor [20%]

(d) Show that the output V_0 of the following Differential Amplifier(refer the figure on the next page) is given by

$$V_0 = V_2 \frac{(R_f + R_1)R_3}{(R_3 + R_2)R_1} - V_1 \frac{R_3}{R_1}$$ [40%]



Q6. (a) A logic gate circuit diagram is given bellow. If A is the input and Q is the out put then complete the truth table.



(i) Name the type of the logic gate.

(ii) Draw and label the symbol for this logic gate. [30%]

(b) A simple audible warning system for a motorcar is activated $(W=1)$ when the engine is running $(E=1)$ and either the oil pressure is too low $(P=0)$ or the alternator is not charging $(C=0)$. To implement this warning system, draw a logic circuit using NOT and NAND gates.

[70%]

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