University of Vavuniya

First Examination in Information and Communication Technology – 2020
Second Semester – December 2022

ICT 1243 Electronics and Digital Circuit Designs

Answer Four Questions only

Time: Two hours

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

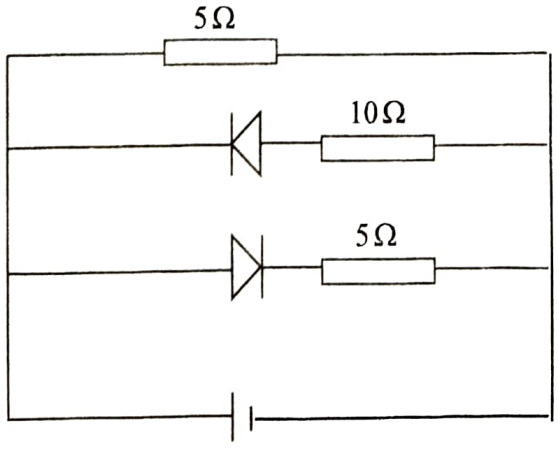
(b) Name three acceptor and three donor materials used for doping semiconductor. [20%]

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

(d) The intrinsic resistivity of germanium at 300K is $50\,\Omega$ cm. The electron and hole mobilities are $\mu_e = 3600\ cm^2\ V^{-1}\ s^{-1}$ and $\mu_h = 1900\ cm^2\ V^{-1}\ s^{-1}$ respectively. Find the intrinsic carrier concentration in the semiconductor? [30%]

Q2. (a) Sketch and explain the forward and reverse characteristic of a p-n junction. [30%]

(b) What currents will flow through each of the three branches of the following circuit. The knee voltage of the silicon diodes is 0.7V. [40%]

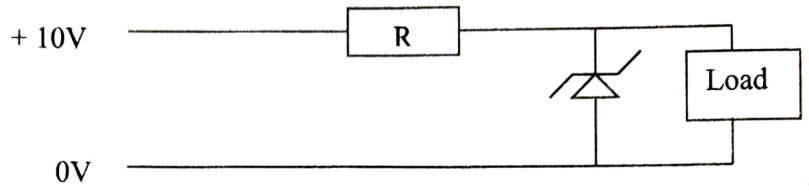


(c) Explain the purpose of a rectifier circuit. [30%]

Q3. (a) Give three different types of diodes and explain their applications. [30%]

(b) Sketch and explain the I – V characteristic of a Zener diode. [30%]

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



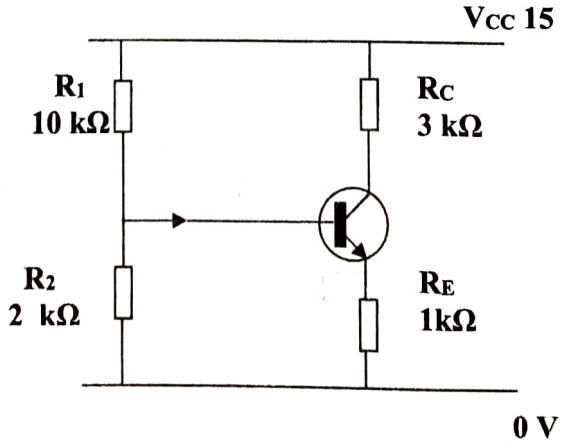
Answer the following questions:

(i) calculate the voltage across R.
(ii) find the ideal value of the resistor.
(iii) if the input voltage now raises to 14V, calculate the new voltage across the R.

Q4. (a) Explain the Transfer characteristics of a transistor in common emitter Configuration using I_c Vs I_B curve. [30%]

(b) What do you mean by transistor biasing? Explain how transistor should be biased in the following circuits.
(i) Transistor as an amplifier
(ii) Transistor as a switch [30%]

(c) Compute the base, emitter and collector voltages for the voltage divider bias npn transistor circuit shown in the below figure. [40%]



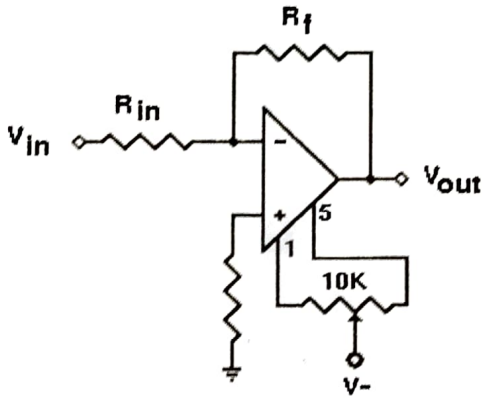
Q5. (A)

(a) List the advantages of using integrated circuits (ICs) compared to discrete circuits. [15%]

(b) What is the use of offset null connection in the operational amplifier? [10%]

(c) Show that the "closed loop gain" **A** and "open – loop gain" $\mathbf{A_o}$ of an operational amplifier which can be related as $A = \frac{A_o}{1 + \beta A_o}$ where β is the feedback factor. [15%]

(d) Find the closed – loop gain of the inverting amplifier as shown in the figure below. [40%]



(B) A logic gate with the inputs **A**, **B** and output **Q** has the following truth Table.

A	B	Q
0	0	0
0	1	1
1	0	1
1	1	0

(i) Name the type of the logic gate. [10%]

(ii) Draw and label the symbol for this logic gate. [10%]

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