Total No. of printed pages = 6

ET 131305 OR

Roll No. of candidate | | | | | | | | | | |

2019

B.Tech. (EE) 3rd Semester End-Term Examination

ANALOG ELECTRONICS

(Old Regulations)

Full Marks – 100 Time – Three hours

The figures in the margin indicate full marks for the questions.

(Answer to Question no.1 and any *six* from the rest.)

1. Answer *all* questions : (10 × 1 = 10)

   (i) What do you mean by donor acceptor impurities?

   (ii) What is the energy band gap of Ge at 300K?

   (iii) Define mass – action law.

   (iv) Define dynamic resistance of a diode.

   (v) What is a transistor? Why is it so called?

   (vi) Why is collector wider than emitter and base?

   (vii) What do you mean by feedback in amplifiers?

[Turn over

(viii) For an inverting amplifier, if $R_1 = 1k\Omega$ and $R_F = 10\ k\Omega$ The closed loop gain is

(a) 10 (b) 11

(c) −10 (d) 100

(ix) Define CMRR in op–amps.

(x) If transistor has a $\alpha = 0.97$, the value of β is

(a) 0.03 (b) 32.33

(c) 200 (d) 100

2. (a) What do you mean by Fermi level? Draw Fermi energy level for p-type, n-type and intrinsic semiconductor. (5+10=15)

(b) Define mean free path and mean free time.

Find the conductivity of silicon:

(i) in intrinsic condition at 300K

(ii) with donor impurity of 1 in 10^8

(iii) with acceptor impurity of I in 5×10^7

(iv) with both the above impurities simultaneously

Given that for silicon at room temperature $n_I = 1.5\times10^{10}/cm^3$, $\mu_n = 1300 cm^2/V\text{-}s$, $\mu_p = 500 cm^2/V\text{–}s$ and number of silicon atoms/$cm^3 = 5\times10^{22}$.

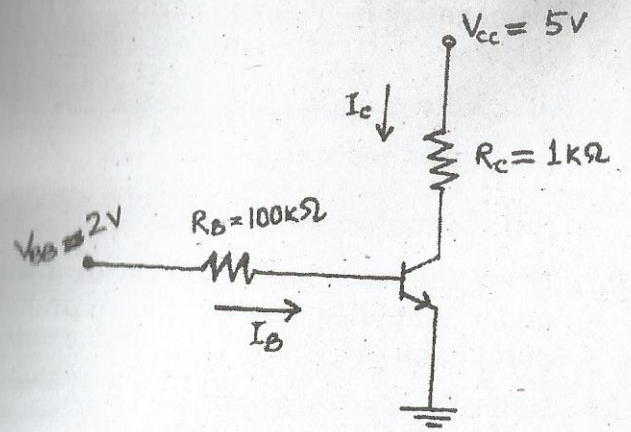
3. (a) Describe P-N junction in forward bias and reverse bias conditions. (5+10=15)

(b) Explain the formation of the depletion region in P-N junction diode with the derivation of the depletion width.

4. (a) Determine the forward resistance of a P-N junction diode when the forward current is 5mA at T=300K. Assume silicon diode. (5+5+5=15)

(b) Draw the comparison of CB, CC, CE configuration of BJT.

(c) Determine the base, collector and emitter currents and V_{CE} for a CE circuit shown below. For V_{CC}=5V, V_{BB}=2V, R_B=100kΩ, R_C=1kΩ, V_{BE}=0.7V, β=100.



5. (a) Describe the Ebers-Moll model with circuit diagram.

(b) Describe the operation of NPN transistor in CB configuration.

(c) Find I_B, I_C, V_{CE} and S for fixed bias circuit. Given, V_{CC}=16V, R_B=470K, R_C=2.7K, β=90 (5+5+5=15)

6. (a) What is early effect? Define punch through. (4+4+3+4=15)

(b) Why the stability of Q-point is necessary? What are the causes of instability of a Q-point?

(c) Explain how negative feedback amplifier helps in reducing distortion and noise?

(d) What are the different ways of connecting a feedback signal in an amplifier? Derive an expression for input resistance of a voltage series feedback.

7. (a) An amplifier with 2.5KΩ input resistance and 50KgΩ output resistance has a voltage gain of 100. The amplifier is now modified to provide 5% negative feedback in series with the input, calculate

(i) Voltage gain

(ii) Input resistance

(iii) Output resistance (5+5+5=15)

(b) Draw the schematic diagram of a summing or adder amplifier. Derive the expression of the output voltage.

(c) Indicate a op–amp connected as a

(i) Scale changer

(ii) High pass filter

(iii) Subtractor

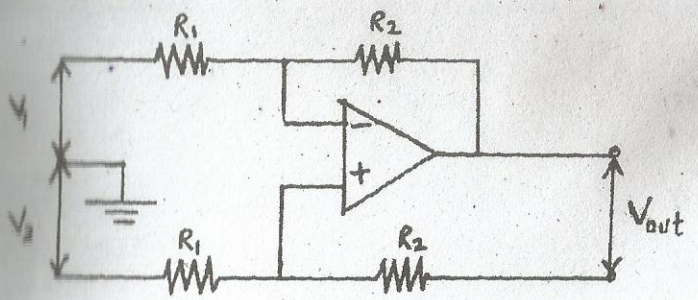
(iv) Voltage follower

(v) Integrator

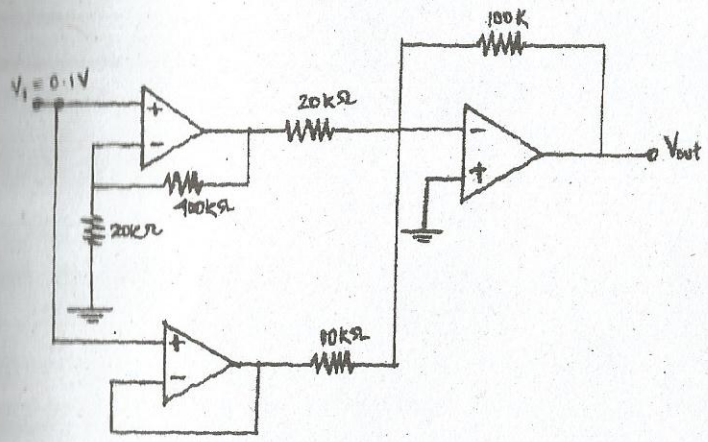
For each case get the relevant expression for V_{out}.

8. (a) Draw the pin configuration of IC 741. Define input offset voltage, input bias current and input offset current. (5+5+5=15)

(b) Prove that $V_{out} = \frac{R_2}{R_1}(V_2 - V_1)$ for the circuit shown.



(c) Find the output voltage V_{OUT}



9. Write short notes on (any three) (5+5+5=15)

(a) Avalanche breakdown

(b) Topologies of feedback amplifiers

(c) Voltage divider biasing

(d) Operating modes of op-amp
