Total Marks: 100 Marks

Course Title: Electronics (1) | Course Code: EEC1101 | Year: First Year
Date: March 2021 (First term) | Allowed time: 3 hrs | No. of Pages: 02

Remarks: (answer the following questions... assume any missing data... answers should be supported by sketches...etc)

Question number (1) (25 Marks)

1 (a) Choose the right answer :

1. The ideal diode is an open circuit in the region of conduction and short in the region of nonconduction. ( ) *True* (✓) *False*
2. In forward –bias region the diode current increases linearly with increase in voltage across the diode. ( ) *True* (✓) *False*
3. The capacitance of a diode increases linearly with increase in the forward –bias voltage. ( ) *True* (✓) *False*
4. The peak inverse voltage of a diode determine the maximum voltage across the diode under forward –bias condition. ( ) True (✓) False
5. Clippers are circuits that clamp the input signal to a different dc levels. ( ) *True* (✓) *False*
6. In the cutoff region the base-emitter and collector -base junctions of a transistor are both forward- biased. ( ) *True* (✓) *False*
7. Transconductance is inversely proportional to the collector current of a transistor. ( ) *True* ( ) *False*
8. Avalanche breakdown voltage is inversely proportional to temperature. ( ) *True* ( ) *False*
9. A center-tapped rectifier is a type of full-wave rectifier that uses four diodes connected to the secondary of a center-tapped transformer. ( ) *True* ( ) *False*
10. Emitter degeneration decreases the output impedance of a common emitter amplifier. ( ) *True* ( ) *False*

(b) Derive an expression for the built in potential in terms of junction parameters

(c) Consider a pn junction at T= 300K in which $I_S = 10^{-14}$ A .Find the diode current for $v_D = +0.7$ V and $v_D = -0.7$ V .

DIO = 5

Question number (2) (25 Marks)

(a) A diode operates in the forward bias region , if we wish to increase the current by a factor of 5 (How much change in in V_D is required?)

(b) Describe and analyze the Hall effect, show how to calculate the value of electron and hole mobilities of a semiconductor materials.

(c) A pn junction with $N_D = 9 \times 10^{15}$ cm^{-3} and $N_A = 2 \times 10^{16}$ cm^{-3} .Determine the capacitance of the device with :

: (i) $V_R = 0$ (ii) $V_R = 1$ V

$n_i = 1{,}08 \times 10^{10}$ cm^{-3} , $q = 1.6 \times 10^{-19}$ C , $\varepsilon_{Si} = 11.7 \times 8.85 \times 10^{-14}$ F/cm

Question number (3) (25 Marks)

(a) For the circuit shown in Fig.1b (a ,b) ,determine the change in V_{out} if V_{in} changes from 2.4V to 2.5 V. Assuming constant voltage model .

(b) Draw the circuit diagram of a bridge rectifier circuit with an RC filter. Draw the output voltage waveform, and explain how the magnitude of the ripple voltage can be reduced.

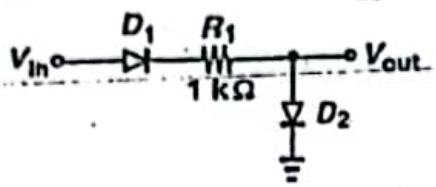
(c) Determine whether each diode in Fig2 (a ,b) is forward biased or reverse biased .Then determine the voltage across each diode , assuming $V_D = 0.7V$

Question number (4) (25 Marks)

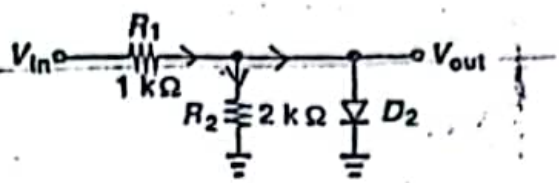
(a) For the circuit shown in Fig.3, determine : R_C, R_E, R_B, V_{CE}, and V_B

(b) Explain the difference between simple biasing and biasing with emitter degeneration of npn bipolar transistor. State the advantageous and disadvantages of each.

(c) A CE stage is biased at a collector current of 1 mA .If the circuit provides a voltage gain of 20 with no emitter degeneration and 10 with degeneration ,determine R_C and R_E, and the input and output impedances . Assume $\beta = 100$



(a)



(b)

Fig.1

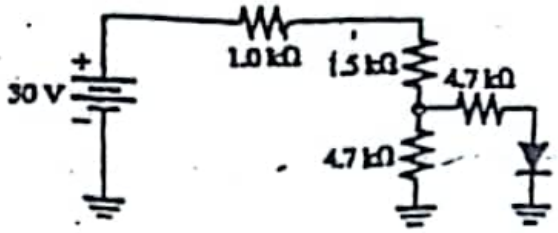
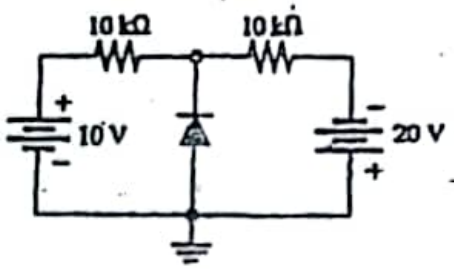


Fig.2 (a)



(b)

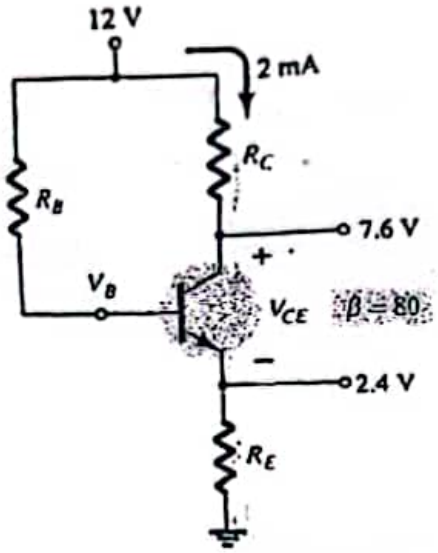


Fig.3