

Code: DE06
Time: 3 Hours

JUNE 2008

Subject: BASIC ELECTRONICS
Max. Marks: 100

NOTE: There are 9 Questions in all.

- Question 1 is compulsory and carries 20 marks. Answer to Q. 1. must be written in the space provided for it in the answer book supplied and nowhere else.
- Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.
- Any required data not explicitly given, may be suitably assumed and stated.

Q.1 Choose the correct or best alternative in the following: (2x10)

- a. The colour band sequence of a resistor is Yellow, Violet, Orange and Gold. The range in which its value must lie so as to satisfy the tolerance specified is between
- (A) 44.66 K Ω and 49.35 K Ω (B) 44.65 K Ω and 49.35 K Ω
(C) 44.65 K Ω and 49.36 K Ω (D) 45 K Ω and 49.34 K Ω
- b. With increasing temperature, the resistivity of an intrinsic semiconductor decreases. This is because, with the increase of temperature
- (A) The carrier concentration increases but the mobility of carriers decreases.
(B) Both the carrier concentration and mobility of carriers decreases.
(C) The carrier concentration decreases, but the mobility of carriers increases.
(D) The carrier concentration remains the same but the mobility of carriers decreases.
- c. At room temperature of 25°C, the barrier Potential for Silicon is 0.7V. Its value at 0°C will be
- (A) 0.7 V. (B) 0.65 V.
(C) 0.75 V. (D) 0.55 V.
- d. Which of the following is a unipolar device?
- (A) P-N junction diode (B) Zener diode
(C) Tunnel diode (D) Schottky diode
- e. On applying a Positive voltage signal to the base of a normally biased N-P-N CE transistor amplifier
- (A) Base current will fall.
(B) Collector current will fall.
(C) Emitter current will fall.
(D) Collector voltage will become less positive.
- f. An N-channel JFET has Pinch-off Voltage of $V_P = -4V$ and given that $V_{GS} = -1V$, then

the minimum V_{DS} for the device to operate in the Pinch-off region will be

- (A) +1V (B) +3V
(C) +4V (D) +5V

g. The extremely high input impedance of a MOSFET is Primarily because of

- (A) Absence of its channel
(B) Depletion of current carriers
(C) Extremely small leakage current of its gate capacitor
(D) Negative V_{GS}

h. When two identical SCRs are placed back-to-back in series with a load and if each is fired at 90° , then the voltage across the load will be

- (A) $\frac{2}{\pi} \times \text{Peak Voltage}$ (B) Zero
(C) $\frac{1}{\pi} \times \text{Peak Voltage}$ (D) $\frac{1}{\sqrt{2}} \times \text{Peak Voltage}$

i. The most commonly used type of electron emission in electron tubes is

- (A) Photo-electron emission. (B) Thermionic emission.
(C) Field emission. (D) Secondary emission.

j. In the differentiating circuit shown in Fig.1, the function of resistor R_1 is to

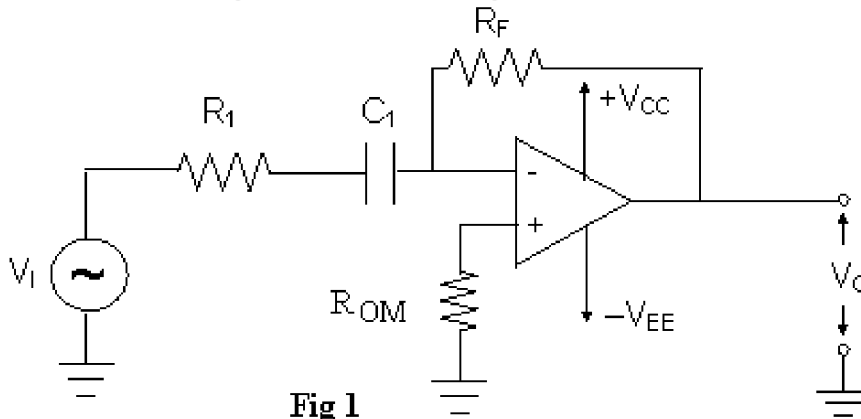


Fig 1

- (A) Enable the circuit to approach ideal differentiator
(B) Maintain high input impedance
(C) Eliminate high frequency noise spikes
(D) Prevent oscillations at high frequencies

Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.

- Q.2** a. What is an inductor? Explain briefly various types of fixed inductors employed in electronic industry. What is the role of variable inductors in radio receiver? (6)
- b. Differentiate between a current source and a voltage source. Give their graphical representations. How can they be converted from one another? Determine the current flowing through 7Ω resistor in the circuit shown in Fig. 2 by using source transformation technique. (10)

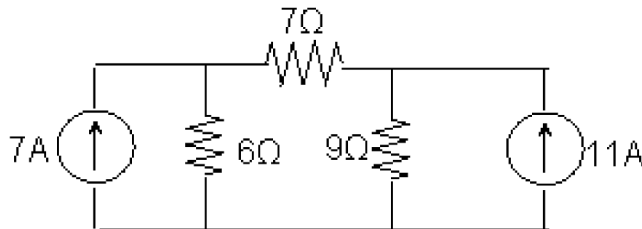


Fig 2

- Q.3** a. “As regards conduction of current in concerned, a semiconductor is bipolar in nature whereas a metal is unipolar”-Justify (or) nullify the above statement. (7)
- b. Explain what do you understand by intrinsic, N-type and P-type semiconductors. Discuss the position of Fermi level in each case (9)
- Q.4** a. Discuss the reasons for the existence of a depletion layer in a P-N junction. Relate it to the rectifying properties of a P-N junction. (10)
- b. What is a Zener diode? Explain, with the help of a circuit diagram. How Zener diode can be used as a voltage regulator? (6)
- Q.5** a. Explain the operation of JFET as an analog switch. (7)
- b. Compare the characteristics of CB, CE and CC configurations of a transistor. Draw the circuit of a common collector transistor configuration and explain its operation. Also derive the relation between β and α current amplification factors. (9)
- Q.6** a. Explain with a diagram the operation of Positive adjustable voltage regulator and derive an expression for output voltage. (9)
- b. In a centre-tap full-wave rectifier, the load resistance $R_L=1K\Omega$. Each diode has a forward-bias dynamic resistance r_d of 10Ω . The voltage across half the secondary winding is $220 \sin 314t$. Find
(i) the Peak value of current

- (ii) the dc or average value of current
- (iii) the rms value of current
- (iv) the ripple factor and
- (v) the rectification efficiency (7)

- Q.7**
- a. Why are MOSFETs available in both enhancement and depletion modes, while JFETs operate almost invariably in the depletion modes. (4)
 - b. Sketch the output characteristics for N-channel JFET with gate-source voltage shorted (i.e. $V_{GS}=0$). How Ohmic, Pinch-off and Breakdown regions are created? (8)
 - c. For an N-channel JFET, $I_{DSS} = 8.7\text{mA}$, $V_P = -3\text{V}$ and $V_{GS} = -1\text{V}$, then find the value of drain current (I_D). (4)

- Q.8**
- a. Describe the structure, symbol and operation of SCR with the help of suitable diagrams. (8)
 - b. What is monolithic IC? Explain photolithographic Process in monolithic IC Production. (8)

- Q.9**
- a. Explain the following terms as referred to an operational amplifier
 - (i) Input offset Voltage
 - (ii) Input offset Current
 - (iii) Slew Rate
 - (iv) CMRR (12)

- b. An operational amplifier shown in Fig.3 has feedback resistor $R_f = 12\text{K}\Omega$ and the resistances in the input sides are $R_{S1} = 12\text{K}\Omega$, $R_{S2} = 2\text{K}\Omega$ and $R_{S3} = 3\text{K}\Omega$. The corresponding inputs are $V_{i1} = +9\text{V}$, $V_{i2} = -3\text{V}$ and $V_{i3} = -1\text{V}$. Non-inverting terminal is grounded. Calculate the output voltage. (4)

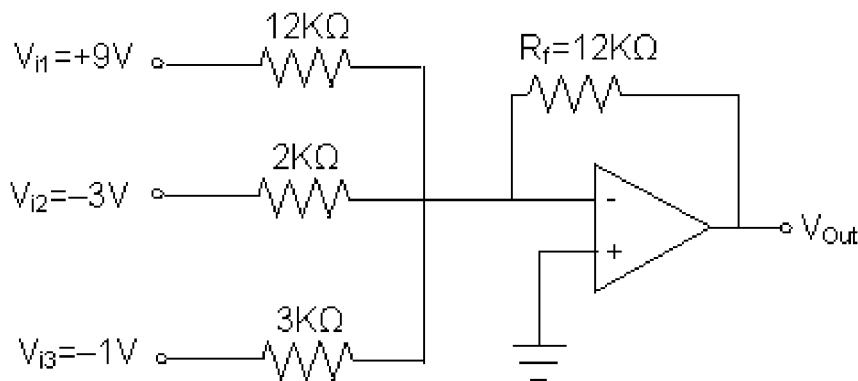


Fig 3