

Code: DE06
Time: 3 Hours

Subject: BASIC ELECTRONICS
Max. Marks: 100

NOTE: There are 9 Questions in all.

DECEMBER 2007

- 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) 40K Ω and 42.5K Ω (B) 44.65 Ω and 49.3 Ω
(C) 44.65K Ω and 49.35K Ω (D) 43.25K Ω and 45.22K Ω
- b. A device whose characteristics are very close to that of an ideal voltage source is
- (A) a vacuum diode. (B) a DIAC.
(C) a zener diode. (D) a FET.
- c. The forbidden energy gap in semiconductors
- (A) lies just below the valance band
(B) lies just above the conduction band
(C) lies between the valence band and the conduction band
(D) is the same as the valence band
- d. The barrier potential for a Ge PN junction is
- (A) 0.6V. (B) 0.3V.
(C) 0.1V. (D) 0.5V.
- e. The ripple factor of a power supply is a measure of
- (A) its voltage regulation. (B) its diode rating.
(C) purity of power output. (D) its filter efficiency.
- f. In a BJT, if the emitter junction is reverse-biased and the collector junction is reverse-biased, it is said to operate in
- (A) in active region (B) in saturation region
(C) in cut-off region (D) none of the above
- g. In the switching type of voltage regulators, the power efficiency will be of the order of
- (A) 50% or less. (B) 60%.
(C) 40% or more. (D) 90% or more.
- h. The resistance between bases of a UJT is typically in the range of
- (A) 2 to 3 K Ω (B) 5 to 10 K Ω
(C) 15 to 20 K Ω (D) 18 to 20 K Ω
- i. The quantity that serves as a figure of merit for a DIFF AMP is
- (A) slew rate. (B) bandwidth.
(C) input bias current. (D) CMRR.

j. Practical range of resistance values obtainable with base diffused resistors is

- (A) 10 Ω to 1 K Ω (B) 20 Ω to 30 K Ω
 (C) 5 Ω to 3 K Ω (D) 20K Ω to 50 K Ω

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

- Q.2** a. Why are resistors, capacitors and inductors called passive components? Write a note on moulded-carbon composition resistor. How are active components broadly classified? (6)
- b. What do you mean by a constant current source? Write its symbolic representation. What is the symbol for a practical current source? Given an a.c. current source of strength 0.2A and impedance 100 ohms, write an equivalent voltage-source representation for this source. (8)
- c. State Thevenin's theorem. (2)
- Q.3** a. What type of material can conduct electricity in it? Write the energy band diagrams for metals and insulators and briefly explain. (8)
- b. Briefly describe the effect of temperature on the conductivity of intrinsic semiconductors. (3)
- c. Explain the operation of a PN-junction under forward bias condition. (5)
- Q.4** a. A bridge rectifier is driven by a transformer of turns ratio $n_1 : n_2 = 12 : 1$. If the primary of the transformer is connected to the 220V, 50Hz, 1 ϕ power mains, evaluate the following for the rectifier:
 (i) the dc load voltage (ii) the PIV of each diode
 (iii) the dc load current
 Assume the diodes to be ideal. (7)
- b. Explain the operation of a voltage tripler with a suitable diagram. (6)
- c. Mention the effects of increasing the capacitance of a shunt capacitor filter on the performance of a rectifier. (3)
- Q.5** a. Define the term percentage regulation of a power supply. An unregulated voltage source of resistance 600 ohms is connected across a zener diode to form a shunt regulator. Zener diode used has the following parameters:
 Breakdown voltage = 5.1 volts,
 Zener resistance (r_z) = 10 ohms;
 Minimum and maximum values of current through zener = 1 mA and 15 mA respectively.
 Determine the minimum and maximum values of the input voltage which can be regulated by the zener. (12)
- b. Why do the regulated supplies include current limiting? Name the building block of the first generation IC voltage regulators like the $\mu A 723$. What is the disadvantage of these early IC regulators? (4)
- Q.6** a. What is a transistor? Define a common-emitter configuration. Show that for a CE configuration $I_C = \beta_{dc} \cdot I_B + I_{CEO}$ with usual notations. (9)
- b. When the emitter current of a transistor is changed by 1mA, its collector changes by 0.995 mA. Evaluate the common-base short circuit current gain and the common-emitter short circuit current gain for the transistor. (4)
- c. Write the input characteristics of a PNP transistor connected in common-emitter configuration. (3)
- Q.7** a. What are the advantages of FETs over BJTs? Write the structure of an N-channel JFET. What do you mean by PINCH-

OFF voltage of a JFET? (9)

b. Write a brief note on UJT. (7)

Q.8 a. Write the circuit of the most general form of a differential amplifier using BJTs and briefly explain. (6)

b. Write the circuit of an OPAMP noninverting voltage feedback amplifier and deduce the equation for its closed-loop gain. (6)

c. Write the circuit of a current-to-voltage converter using an OPAMP and explain its operation. (4)

Q.9 a. What are photoelectrons? Light of wavelength 4000×10^{-10} m, falls on a metal having work function of 1.5eV. Determine
(i) the energy of incident photon and
(ii) the kinetic energy of photoelectrons.

Take Planck's constant as 6.62×10^{-34} Js. (8)

b. Define the following terms as used in IC fabrication:

(i) Chip (ii) Diffusion (iii) Etching. (4)

c. Briefly explain a Schottky diode. (4)