SPECIAL SUPPLE B.TECH/AEIE/BT/CE/CHE/CSE/ECE/EE/IT/ME/1ST & 2ND SEM/ECEN 1001/2018

BASIC ELECTRONICS ENGINEERING
(ECEN 1001)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) The atom that can act as a donor in Si is
(a) Gallium (b) Arsenic
(c) Indium (d) Aluminium.

(ii) If the differential voltage gain and the common mode voltage gain of a differential amplifier are 48 dB and 2 dB respectively, then its common mode rejection ratio is
(a) 23 dB (b) 25 dB
(c) 46dB (d) 50 dB.

(iii) In Enhancement n-channel MOSFET, an induced n type channel can be produced between the source and the drain if
(a) $V_{GS} = 0$ (b) V_{GS} is positive
(c) V_{GS} is negative (d) none of these.

(iv) In which mode of BJT operation, emitter base junction is forward biased and collector base junction is reverse biased?
(a) active (b) saturation
(c) cut off (d) reverse active.

(v) In a half wave rectifier, if V_m is the peak voltage across the secondary, Peak Inverse Voltage (PIV) is
(a) V_m (b) $2V_m$ (c) $V_m/2$ (d) $V_m/\sqrt{2}$.

(vi) The ripple factor of a bridge rectifier is
(a) 0.482 (b) 0.812 (c) 1.11 (d) 1.21.

(vii) Positive feedback is used in

(a) amplifiers	(b) rectifiers
(c) oscillators	(d) detectors.

(viii) JFET is a
(a) current controlled device
(b) voltage controlled device
(c) temperature controlled device
(d) none of these.

(ix) When a reverse bias is applied across a diode, it will
(a) raise the potential barrier
(b) lower the potential barrier
(c) increases the majority-carrier current greatly
(d) none of these.

(x) The value of CMRR for an ideal op-amp is
(a) 0 (b) 50 (c) 1 (d) Infinity.

Group – B

2. (a) Distinguish between metal, semiconductor and insulator.

(b) Calculate the resistivity of intrinsic silicon at 300K if it has intrinsic carrier concentration $n_i = 1.5 \times 10^{16}$ m^{-3}, electron mobility $\mu_n = 0.13$ m^2/Vs, hole mobility $\mu_p = 0.05$ m^2/Vs.

(c) Explain how a Zener diode can be used for voltage regulation?

3 + 5 + 4 = 12

3. (a) Explain the operation of a full wave rectifier with the help of a circuit diagram.

(b) Evaluate the ripple factor and efficiency of a full wave rectifier.

6 + 6 = 12

Group – C

4. (a) Draw the output characteristics of an npn Bipolar Junction Transistor operating in the Common Base mode. Indicate and explain the various regions of operation.

(b) What is Early effect?

(c) What is a load line. Explain the concept of Q-point.

6 + 2 + 4 = 12

5. (a) Define Stability Factor of Bipolar Junction Transistor and state its significance.

(b) Draw the circuit diagram for fixed bias considering an npn transistor in CE mode. Derive the expression for its stability factor.

(c) Mention the merits and demerits of this arrangement.

4 + (3 + 3 + 2) = 12

Group – D

6. (a) Describe the working principle of n-channel JFET with neat diagram.

(b) Draw the drain characteristics of n-channel JFET and mark the various regions of operation.

(c) Explain how it can be used as a Voltage Variable Resistor (VVR).

6 + 4 + 2 = 12

7. (a) Draw a neat sketch of the n-channel depletion type MOSFET and explain its working principle.

(b) Define the FET parameters and derive the relationship between them.

(4 + 4) + 4 = 12

Group – E

8. (a) Draw the circuit diagram and derive the input output relationship of
   (i) an adder using op-amp
   (ii) a non-inverting amplifier using op-amp

(b) Describe the use of an op-amp as a differentiator. Draw appropriate input and output waveforms.

(3 + 3) + (4 + 2) = 12

9. Write short notes on any three: **3 × 4 = 12**
   (i) Lissajous figure
   (ii) Fermi level
   (iii) Barkhausen Criterion
   (iv) Feedback topologies.