

**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) Avalanche breakdown is primarily dependent on the phenomenon of  
(a) Collision (b) Doping  
(c) Ionization (d) Recombination.
- (ii) In an intrinsic semiconductor, the number of electrons is equal to the number of holes at which temperature?  
(a) 0K (b) 0°  
(c) high temperature (d) all temperature.
- (iii) Silicon diodes are less suited for low voltage rectifier operation  
(a) cannot withstand high temperature  
(b) reverse saturation current is low  
(c) cutin voltage is high  
(d) breakdown voltage is high.
- (iv) The current  $I_{CBO}$  flows in the  
(a) emitter and base leads (b) collector and base leads  
(c) emitter and collector leads (d) none of these.
- (v) Mobility of electrons in N-channel JFET and mobility of holes P-channel JFET are  
(a) large, poor (b) poor, large  
(c) large, large (d) poor, poor.

- (vi) The effective channel length of a MOSFET in saturation decreases with increase in  
(a) gate voltage (b) drain voltage  
(c) source voltage (d) body voltage.
- (vii) An operational amplifier is basically a  
(a) low gain ac amplifier  
(b) high gain dc amplifier  
(c) high gain RC coupled amplifier  
(d) low gain transformer-coupled amplifier.
- (viii) For a step input, the output of an integrator is  
(a) a pulse (b) a triangular waveform  
(c) a spike (d) a ramp.
- (ix) An oscillator whose frequency is changed by a variable dc voltage, is known as  
(a) a crystal oscillator (b) a VCO  
(c) an Armstrong oscillator (d) a piezoelectric device.
- (x) The feedback in emitter follower is  
(a) 50% (b) 100% (c) 0% (d) 0.1%.

### Group - B

2. (a) What is the basic difference among metal, insulator and semiconductor?  
(b) Plot the Fermi-Dirac probability function at 0K and 300K for Intrinsic and N type extrinsic semiconductor.  
(c) Calculate the density of impurity atoms that must be added to an intrinsic silicon crystal to convert it to (i)  $10^{-4}$  ohm-m N type silicon, (ii)  $10^{-4}$  ohm-m P type silicon. The electron and hole mobility for silicon are  $\mu_e = 0.138m^2 / volt - sec$  and  $\mu_h = 0.046m^2 / volt - sec$ .
- 3 + 5 + 4 = 12**
3. (a) What are the difference between avalanche breakdown and zener breakdown?  
(b) Explain with a circuit diagram the use of a zener diode as a reference diode.  
(c) Explain the operation of a full wave rectifier with the help of a circuit diagram.

**2 + 5 + 5 = 12**

### Group - C

4. (a) The metal lead of the p-side of a p-n diode is soldered to the metal lead of the p-side of another p-n diode. Will the structure form an n-p-n transistor? Why?
- (b) Explain the operation of NPN transistor in CB configuration with proper circuit diagram. What is early effect?
- (c) The collector leakage current in a transistor is  $300\mu A$  in CE arrangement. If the transistor is now connected in CB arrangement, what will be the leakage current? Given that  $\beta = 100$ .
- 2 + (5 + 2) + 3 = 12**
5. (a) What are the factors that affect the bias stability of a transistor? What is thermal runaway in transistor amplifier circuit?
- (b) Establish the relationship between  $\alpha$  and  $\beta$ .
- (c) The reverse saturation current in NPN transistor in common base configuration is  $15.5\mu A$ . For an emitter current of 4 mA, collector current is 2.47 mA. Find the value of current gain and base current.
- (3 + 2) + 3 + 4 = 12**

### Group - D

6. (a) What is the significance of the term field-effect? Why the field effect transistor is called a unipolar transistor?
- (b) Define the various parameters of a JFET. What is the relation between JFET parameters?
- (c) An N Channel JFET has a pinch-off voltage of -4.5 v and  $I_{DSS} = 9mA$ . What is the value of  $V_{GS}$  and  $g_m$  for  $I_{DS} = 3mA$ ?
- (2 + 2) + (2 + 3) + 3 = 12**
7. (a) When the channel of JFET is said to be pinched off? Explain the difference between enhancement and depletion type MOSFETs.
- (b) Explain the basic construction of an enhancement type N-channel MOSFET. Draw and explain its static characteristics.
- (2 + 2) + (4 + 4) = 12**

### Group – E

8. (a) Define degenerative and regenerative feedback system. What are the possible topologies of a feedback amplifier?
- (b) What is Barkhausen criterion for the feedback oscillator?
- (c) An amplifier has a gain of 60 and distortion 10% without feedback. Determine (i) gain and (ii) distortion when negative feedback is applied, the feedback factor being 6.

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

9. (a) Explain the concept of virtual ground in an OPAMP. How is it different from a real ground?
- (b) Describe the use of an op-amp as an integrator. Derive the input output relation. Draw appropriate input output waveforms.
- (c) What is the maximum closed-loop voltage gain that can be used when the input signal varies by 0.5 V in 10  $\mu$ s, for an op-amp having slew rate (SR) = 4v/ $\mu$ s?

**4 + 5 + 3 = 12**

Department & Section	Submission Link (for Backlog)
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