NOV - DEC- 2018 EXAMINATION
II - B. E. (4 YDC) EXAM.
EI-27003: ELECTRONIC DEVICES AND CIRCUITS

Time: 3 Hrs.]

[Max. Marks : 70
[Min. Pass Marks : 22

TOTAL NO. OF QUESTIONS IN THIS PAPER : 5

Note: There are Five questions in this paper. Each question has four subparts a, b, c and d. Attempt **ANY ONE** from a & b and **ANY ONE** from c & d.

Q.1 (a) What do you mean by drift and diffusion current in semiconductor? Show that the total hole current in Semiconductor is given by: **07**

$$J_p = q.\mu_p.p.\epsilon - q.D_p\,(dp/dx)$$

(b) Describe the Hall Effect. Derive the equation for Hall Voltage (V_H). List the applications of Hall effect. **07**

(c) Derive the Einstein's equation giving the relation between mobility and diffusivity of Semiconductor. **07**

(d) Explain the operation of Tunnel diode with its V-I characteristics. What are the applications of tunnel diode? **07**

Q.2 (a) For silicon pn junction diode, show that the Built-in Potential is given by: **07**

$$V_0 = \frac{KT}{q}\ln\frac{N_a N_d}{n_i^2}$$

(b) What are the different resistances and capacitances associated with diode? Explain each one in detail. **07**

(c) What do you mean by bias compensation? Explain with circuit diagram bias compensation for variation in base emitter voltage V_{BE} and variation in I_{CO} **07**

(d) Explain the center-tapped full wave rectifier with neat circuit diagram and waveform. Determine the output waveform for the circuit shown in figure Q.2(c), assume V_γ=0.7V **07**

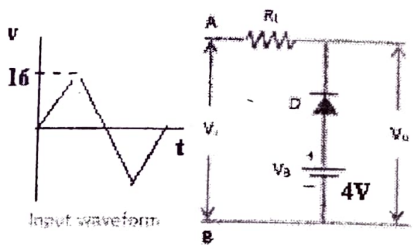

Figure Q.2(c)

Q.3 (a) Derive the H-parameter model for BJT in Common-Emitter (CE) configuration. Give the significance of each parameter. 07

(b) For the voltage divider bias circuit shown in figure Q.3 (b), V_{CC}=18V, R_C=3.3KΩ, R_E=1KΩ, R_1=39KΩ and R_2=8.2KΩ Assuming β=120, determine:
(i) Collector current I_C (ii) Voltage V_{CE}.

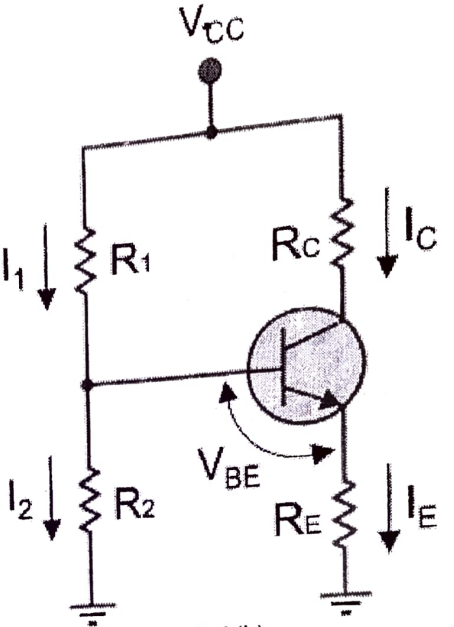

Figure Q.3(b)

(c) Draw the input and output characteristics of BJT in CE-configuration. Explain how the H-parameters can be obtained from these characteristics 07

(d) Write short notes on: 07
(ii)Cascode amplifier (ii) Darlington pair

Q.4 (a) Explain the construction and Operation of N-channel MOS transistor. Obtain the V_{DS} versus I_D characteristic and define the threshold voltage. 07

(b) Consider a process technology for which L_{min}= 0.8μm, t_{ox} =15nm, μ_n=550 cm^2/V-sec, V_t=0.7V. Find 07
(i) C_{ox} and K_n'
(ii) for MOS with W/L=16μm/0.8μm, calculate values of V_{GS} and V_{DSmin} needed to operate transistor in saturation region with a dc current I_D=100μA.
(iii) For a device in part(ii) find value of V_{GS} required to cause the device to operate as 1000ohm resistor for very small V_{DS}.

(c) What do you mean by Short Channel MOS Transistor? Discuss the Drain Induced Barrier Lowering (DIBL) effect.

(d) Discuss the channel length modulation effect in NMOS transistor. Derive the equation for drain current I_D with channel length parameter (λ).

Q.5 (a) Explain the Photolithography process during the IC fabrication. What do you mean by positive and negative photo resist materials?

(b) Discuss the differences and similarities between BJT and MOS Transistor.

(c) Discuss the typical processing sequence for fabrication of MOS integrated circuits. 07

(d) Define the current amplification factor α and β for Common-Base and Common-Emitter transistor. Derive the relation between α and β. 07

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2nd Sem. (EI) Back

APRIL - MAY 2018 EXAMINATION
II - B. E. (4 YDC) EXAM.
EI-27003: ELECTRONIC DEVICES AND CIRCUITS

Time: 3 Hrs.] **[Max. Marks : 70**
[Min. Pass Marks : 22

TOTAL NO. OF QUESTIONS IN THIS PAPER : 5

Note: There are Five questions in this paper. Each question has four subparts a, b, c and d. Attempt **ANY ONE** from a & b and **ANY ONE** from c & d.

Q.1 (a) What is E-K diagram? With the help of E-K diagram, explain photonic and phononic emission in semiconductor. 07

(b) Define Diffusion and Mobility. Give their dimensions. State the Mass action law. Explain its meaning. 07

(c) Explain the construction and operation of Varactor diode, its VI characteristics, type of material used and its applications. 07

(d) Discuss the depletion capacitance and storage capacitance associated with pn junction diode. 07

Q.2 (a) Explain the operation of diode with the help of energy band diagram and the potential profile in (i) forward bias (ii) reverse bias (iii) No bias. 07

(b) Derive the Continuity equation. Give significance of each term. 07

(c) What do you mean by clipper and clamper circuits? Explain operation of positive biased diode shunt clipper for sinusoidal input. 07

(d) Explain the operation of Bridge wave rectifier with appropriate circuit diagram and input/output waveforms. 07

Q.3 (a) Describe Hall effect. Derive the equation for Hall voltage. Give the significance of each term. 07

(b) Discuss the Early's effect and Base width modulation effect in BJT. 07

(c) Define the current amplification factor for common-emitter (CE) and common-base (CB) amplifier. Derive the relationship between them. 07

(d) Why it is necessary to bias the transistor? Explain the various biasing techniques and give the detail explanation of voltage divider bias. 07

Q.4 (a) Explain the operation of n-channel Field Effect Transistor (FET) and show how the pinch-off takes place. What do you mean by self Pinch-off? 07

(b) Discuss the various capacitances associated with the MOS transistor. Draw its capacitance model and give its significance. 07

(c) Write the equations for drain current I_D in triode and saturation regions. Give the significance of these equations. 07

(d) Discuss the differences and similarities between BJT and MOS transistors. 07

Q.5 (a) Discuss the typical processing sequence for fabrication of MOS integrated circuits. 07

(b) Explain the Photolithography process during the IC fabrication. What do you mean by positive and negative photo resist materials? 07

(c) With reference to MOSFET, discuss Drain Punch Through effect. 07

(d) Discuss the base spreading resistance and current crowding phenomenon in BJT. 07

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EI - 3rd sem - Summer Sem

8074

SUMMER SEM JUNE 2017 EXAMINATION
II - B. E. (4 YDC) EXAM. CBCS Scheme
EI-27003: ELECTRONIC DEVICES AND CIRCUITS

Time: 3 Hrs.]

[Max. Marks : 70
[Min. Pass Marks : 22

TOTAL NO. OF QUESTIONS IN THIS PAPER : 5

Note: There are Five questions in this paper. Each question has four subparts a, b, c and d. Attempt ANY ONE from a & b and ANY ONE from c & d

Q.1 (a) Discuss the direct and indirect semiconductors. List their characteristics, examples and applications. 07

(b) Define Diffusion and Mobility. Give their dimensions. Derive the Einstein relation between the Diffusivity and mobility. 07

(c) Define Fermi level. Write the mathematical equation for Fermi-Dirac probability function. Discuss the significance of this equation giving examples 07

(d) Discuss the depletion capacitance and storage capacitance associated with pn junction diode. 07

Q.2 (a) Explain the operation of diode with the help of energy band diagram and the potential profile in (i) forward bias (ii) reverse bias (iii) No bias. 07

(b) Derive the Continuity equation. Give significance of each term. 07

(c) What do you mean by clipper and clamper circuits? Explain operation of positive biased diode shunt clipper for sinusoidal input. 07

(d) Explain the operation of Full wave centre tap rectifier with appropriate circuit diagram and input/output waveforms. 07

Q.3 (a) Describe Hall effect. Derive the equation for Hall voltage. Give the significance of each term. 07

(b) Discuss the Early's effect and Base width modulation effect in BJT. 07

(c) Define the current amplification factor for common-emitter (CE) and common-base (CB) amplifier. Derive the relationship between them. 07

(d) Derive the Charge control model of BJT. The model should consider the normal and inverted mode of BJT. Define the transit time 07

Q.4 (a) Explain the operation of n-channel Field Effect Transistor (FET) and show how the pinch-off takes place. What do you mean by self Pinch-off? 07

(b) What do you mean by Body effect in MOS transistors? With the help of appropriate example, explain how body effect adversely affects the operation of the circuit 07

(c) Explain the construction and working of n-channel MOSFET with suitable diagram. Give its I-V characteristics. Write the equations for drain current I_D in triode and saturation regions. 07

(d) Discuss the differences and similarities between BJT and MOS transistors. 07

Q.5 (a) Discuss the typical processing sequence for fabrication of MOS integrated circuits. 07

(b) Explain the Photolithography process during the IC fabrication. What do you mean by positive and negative photo resist materials? 07

(c) With reference to MOSFET, discuss the DIBL and Punch Through effects. 07

(d) Discuss the base spreading resistance and current crowding phenomenon in BJT. 07

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ATC-406/26

953

NOV - DEC- 2016 EXAMINATION
II - B. E. (4 YDC) EXAM. CBCS Scheme
EI-27003: ELECTRONIC DEVICES AND CIRCUITS

Time: 3 Hrs.] [Max. Marks : 70
[Min. Pass Marks : 22

TOTAL NO. OF QUESTIONS IN THIS PAPER : 5

Note: There are Five questions in this paper. Each question has four subparts a, b, c and d. Attempt **ANY ONE** from a & b and **ANY ONE** from c & d.

Q1 (a) Derive the equation for Drift and Diffusion current in N-type semiconductor. Give its significance. 07

(b) Describe Hall Effect in a semiconductor. Derive relation for Hall voltage V_H. What is the physical significance of Hall coefficient R_H? 07

(c) Discuss the depletion capacitance and storage capacitance associated with pn junction diode. 07

(d) Explain the construction and operation of Tunnel diode, its VI characteristics, type of material used and its applications. 07

Q2 (a) Derive the equation for width of depletion layer of pn-junction diode and show that the width of depletion layer is inversely proportional to doping. 07

(b) What do you mean by clipper and clamper circuits? Explain operation of positive biased diode shunt clipper for sinusoidal input. 07

(c) Explain the operation of Full wave centre tap rectifier with appropriate circuit diagram and input/output waveforms. 07

(d) Define the current amplification factor for common-emitter (CE)and common-base (CB) amplifier. Derive the relationship between them. 07

Q3 (a) Draw the input and output characteristics of BJT in CE-configuration. Explain how the H-parameters can be obtained from these characteristics 07

(b) Compare the CE, CB and CC configurations of BJT. 07

(c) Discuss the Early's effect and Base width modulation effect in BJT. 07

(c) Discuss the Shockley-Read-Hall model for generation and recombination of charge carriers in semiconductors. 07

(d) Explain the operation of Field Effect Transistor (FET) as voltage Variable Resistance (VVR). 07

Q4 (a) Discuss the differences and similarities between BJT and MOS transistors. 07

(b) Explain the construction and Operation of NMOS transistor in linear and 07

saturation region. What do you mean by Pinch-off condition and when does it occur?

(c) Derive the Charge control model of BJT. The model should consider the normal and inverted mode of BJT. Define the transit time. 07

(d) What do you mean by Short channel MOS? With reference to Short channel MOSFET, explain the drain punch-through and Drain Induced Barrier Lowering (DIBL) effect. 07

Q.5 (a) Discuss the channel length modulation effect in NMOS transistor. Derive the equation for drain current ID for NMOS transistor considering channel length modulation parameter (λ). 07

(b) Discuss the various capacitances associated with the MOS transistor. Draw its capacitance model and give its significance. 07

(c) Discuss the oxidation and diffusion process during the fabrication of Integrated Circuits (IC) 07

(d) Discuss the typical processing sequence for fabrication of MOS integrated circuits. 07

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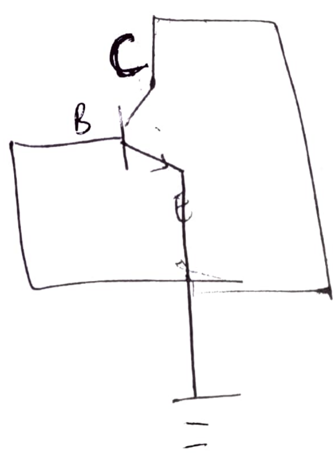
- ~~Measure~~ speed of response
- Measuring lag → time delay → immediate response
- fidelity → degree of fidelity → retardation → after in delay time
- dynamic error — Diff b/w TV − MV of input wrt time



OCT - NOV- 2015 EXAMINATION
II - B. E. (4 YDC) EXAM.
EI-2703: ELECTRONIC DEVICES

Time: 3 Hrs.]

[Max. Marks : 70
[Min. Pass Marks : 22

TOTAL NO. OF QUESTIONS IN THIS PAPER : 5

Note: There are Five questions in this paper. Each question has four subparts a, b, c and d. Attempt **ANY ONE** from a & b and **ANY ONE** from c & d.

Q.1 (a) What do you mean by Elemental and Compound semiconductors? List their examples. Draw the portion of periodic table where semiconductor occurs. 07

(b) Derive the expression of Hall voltage (V_H) for a semiconductor sample place in a uniform magnetic field (B_z) and current (I_x) passing through it? 07

(c) Define Fermi level in semiconductors and hence with help of Fermi-Dirac distribution function, show that all quantum states with energy $E < E_F$ will be occupied by electron at absolute zero temperature (0K). Derive expression for charge carrier concentration ***n*** and ***p*** in terms of Fermi energy level E_F. 07

(d) i. An electric field of 200V/m is applied to a sample of N-type semiconductor whose Hall coefficient is $0.0145 m^3$/coulomb. Calculate the drift current density J in the sample assuming mobility of electron $\mu_e = 0.36\ m^2/V\text{-}s$. (Charge of electron $q = 1.6 \times 10^{-19}$ coulomb) 04

ii. A Si sample is doped with 10^{17} Arsenic atoms/cm^3. What is the equilibrium hole concentration p_o at 300 K? Where is Fermi level E_F relative to intrinsic level E_i? Given that intrinsic carrier concentration $n_i = 1.5 \times 10^{10}$ atoms/cm^3. 03

Q.2 (a) Derive relationship for steady-state minority carrier concentration as a function of distance ***x*** for a long open circuited semiconductor specimen with Light Falls upon one of the end. What is Low-level injection condition? 07

(b) Derive Einstein Relationship to show that two statistical thermodynamic phenomenon, diffusion constant ***D*** and mobility μ are not independent. 07

(c) Derive the Continuity equation for p-type semiconductor and give the importance of continuity equation. 07

(d) What is effective mass? Show that effective mass of an electron is inversely proportional to curvature of energy band. 07

Q.3 (a) Explain band structure in an open circuited pn-junction and hence derive relation for energy band Gap E_G in terms of donor concentration N_D, acceptor concentration N_A & intrinsic carrier concentration n_i. 07

(b) Derive the equation for the Contact Potential (V_0) for the pn junction diode in terms of doping concentration (N_a and N_d) on each side. 07

(c) A P^+N junction has $N_a=10^{20}$cm and $N_d=10^{17}cm^{-3}$. Calculate the following: 07
(i) Contact Potential (V_0) (ii) Width of Depletion layer (W)
(iii) x_N and x_p (Penetration of depletion layer on N side and p side)

(d) A silicon p-n junction with cross-sectional area A = 10^{-4} cm^2 has the following properties at 300K: 07

p side	n side
$N_A = 10^{17}$ cm^{-3}	$N_D = 10^{15}$ cm^{-3}
T_p = 0.1μs	τ_n = 10 μs
μ_p = 450 cm^2/V-s	μ_n = 700 cm^2/V-s

The junction is forward bias by 0.5 V. What is the forward current? Given that intrinsic carrier concentration n_i = 1.5x10^{10} atoms/cm3. Assume recombination factor η=1 and thermal voltage V_T = 26mV at 300K)

Q.4 (a) Draw the input and output characteristics of BJT in CE-configuration. Explain how the H-parameters can be obtained from these characteristics. 07

(b) Derive the charge control model of BJT and give the significance of each term. 07

(c) Show that the collector current in BJT is given by 07

$$Ic = qA\frac{D_p}{L_p}\left(\Delta P_e cosh\frac{W_b}{L_p} - \Delta P_C coth\frac{W_b}{L_p}\right)$$

(d) What do you mean by short channel MOS transistor? List various short channel effects. Discuss Drain Punch through effect. 07

Q.5 (a) Explain the construction and working of n-channel MOSFET with suitable diagram. Give its I-V characteristics. Write the equations for drain current I_D in triode and saturation regions. 07

(b) Explain the process of diffusion and oxidation during the fabrication of MOS Integrated circuits. 07

(c) Explain the Czochralski's method for crystal growth and wafer preparation during IC fabrication. 07

(d) Discuss the typical processing sequence for fabrication of MOS integrated circuits. 07

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NOV. – DEC. - 2013 EXAMINATION
II - B. E. (4 YDC) EXAM.
EI-2702: ELECTRONIC DEVICES

Time: 3 Hrs.] [Max. Marks : 70
[Min. Pass Marks : 22

TOTAL NO. OF QUESTIONS IN THIS PAPER : 5

Note: There are Five questions in this paper. Each question has four subparts a, b, c and d.
Attempt ANY ONE from a & b and ANY ONE from c & d.

Q.1 (a) What do you mean by Drift and Diffusion current in Semiconductor? Write the mathematical expression for Drift and Diffusion current. 04
Calculate the Diffusion current in a piece of germanium having concentration gradient of 1.5×10^{22} electrons/cm^3 and diffusion constant $D_n = 0.0012$ m^2/s. 03

(b) Write the mathematical expression relating the Mobility and Diffusion constant. What is significance of this equation? 04
If the carrier mobility in a sample is 300 m^2/V-Sec at 0°C, What is the diffusion constant of carrier at that temperature given that Boltzman's constant is 1.38×10^{-21} J/K. 03

(c) What is Fermi level in Semiconductor? Where does the Fermi level lie in an intrinsic semiconductor? Show with proper diagram. 04
A Si sample is doped with 10^{17} As atoms/cm^3. What is equilibrium hole concentration p_0 at 300 K? Where is E_F relative to E_i? The intrinsic concentration for Si at room temperature is $n_i = 1.5 \times 10^{10}$ cm^{-3}. 03

(d) Write the mathematical expression for, Fermi-Dirac distribution function. Give its significance. 04
An n-type semiconductor has its Fermi level at 0.25eV below the conduction band edge. Estimate its dopant, majority and minority carrier concentration in equilibrium at room temperature. Assume $n_i = 1.6 \times 10^6$/m^3. 03

Q.2 (a) Discuss the concept of Excess carrier generation and recombination in Semiconductor. Write Continuity equation for electrons. Give its significance. 07

(b) Derive Schrödinger time dependent and time independent wave equations.

(c) A sample of GaAs has 10^{15} electrons/cm^3 and 5×10^{14} holes/cm^3. Find the conduction current density for an applied field of 100 V/cm. If $\mu_e = 5000$ cm^2/V-s and $\mu_p = 400$ cm^2/V-s. 07

(d) Derive the Shockley-Read-Hall model for generation and recombination of charge carriers in semiconductors. 07

Q.3 (a) Write the mathematical expression for Width of transition region of pn-junction diode in terms of contact potential V_0 and doping concentrations N_a and N_d. 02
Aluminum is alloyed into an n-type Si sample ($N_d = 10^{16}$ cm^{-3}), forming an abrupt junction of circular cross section, with a diameter of 0.02 inch. Assume that the 05