

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular/Backlog), November 2017

B. Tech in ECE Engineering, Semester III

Roll No.....

30/11

COURSE CODE: COURSE TITLE:ECE 301

Time: 3 hours

Max. Marks: 100

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.

Q.1A Objective type multiple choice questions (10 questions @ 1 mark) 10

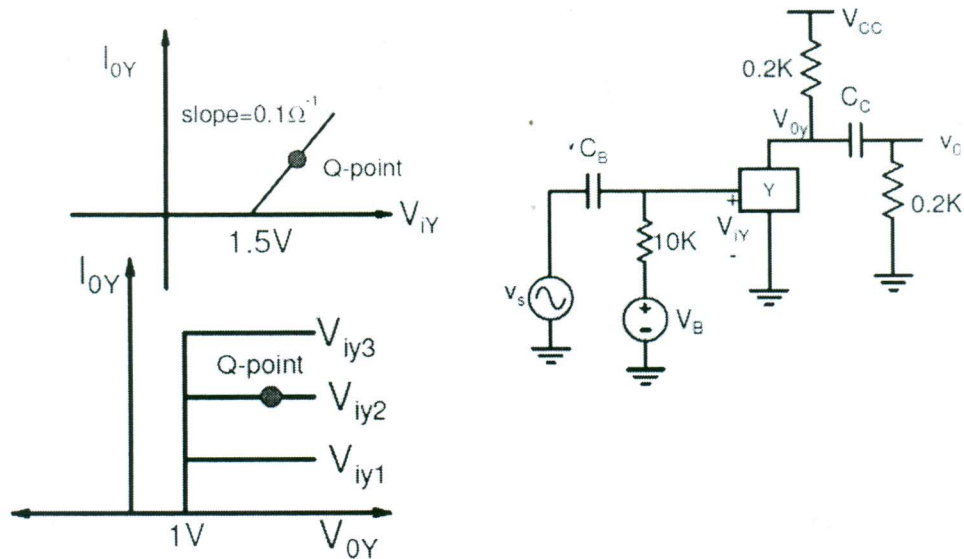
- i. The effective mass of electrons and holes are m_e and m_h respectively. The following relation is true
(A) $m_e = m_h$, (B) $m_e > m_h$, (C) $m_e < m_h$, (D) none of above
- ii. If we dope a semiconductor with a donor impurity, the Fermi level moves closer to (a) Center of Bandgap (B) Conduction band edge (C) Valence Band Edge (d) Vacuum energy level
- iii. Field ionization is caused due to (A) Avalanche breakdown (B) Zener Breakdown (c) Both Avalanche and Zener Breakdowns (D) None of above.
- iv. The diffusion capacitance of diode having $I_D=4\mu A$ and $\tau_p= 1\mu sec$ is
(a) $154 \mu F$ (B) $154 mF$ (c) $154 pF$ (d) $154 nF$
- v. Channel is formed in MOSFET when the device is in
(a) Accumulation Mode (b) Depletion Mode (C) Inversion Mode (D) Forward Active Mode
- vi. In common mode the collector currents of the two BJTs in differential amplifier are (A) Zero (B) Maximum (C)Equal (D) Opposite
- vii. Which type of transistor circuit configuration/s yields the phase-shift of about 180° ?
(A) CC (B) CB (C) CE (D) All of the above
- viii. The disadvantage of Darlington pair is (A) low current gain (B) low input resistance (C) low speed (D) all of above
- ix. The capacitor connected in parallel with emitter resistance is called as
(A)Coupling (B) Clipper (C) Bypass (D) Clamper
- x. MOSFETS have the following disadvantage over BJT
(A) Low packing density (B) low current capacity (C) low capacitances (D) High bandwidth

Q.2 Short answer type questions (4 questions @ 2.5 marks) 10

- (a) What is built in potential? Write the equation for it.
- (b) Draw the diagram showing temperature dependence of mobility of semiconductors.

- (c) Write the properties and applications of Common collector amplifier.
- (d) What is Early effect?
- Q.3A Explain the term Fermi Level. What is dilute carrier approximation? 05
- Q.3B An abrupt Silicon PN Junction has $N_D = 10^{17} \text{ cm}^{-3}$ and $N_V = 5 \times 10^{15} \text{ cm}^{-3}$ at $T = 300 \text{ K}$. What will be difference in Fermi levels of two regions? 05
- Q.4A Draw the energy band diagram of Zener diode and explain quantum mechanical tunneling. 05
- Q.4B Consider a pn junction with $N_A = 10^{17} \text{ cm}^{-3}$ and $N_D = 10^{12} \text{ cm}^{-3}$. Determine the built-in potential assuming intrinsic carrier concentration for Si is $1.5 \times 10^{10} \text{ cm}^{-3}$. 05
- Q.5A Draw the output characteristics of MOSFET. Explain the various regions on the characteristics. 05
- Q.5B Write the equation for Drain Current I_D in cutoff, non-saturation and saturation regions of MOSFET. 05
- Q.6A Draw the circuit diagram of potential divider biasing circuit for MOSFET. Write the mathematical equations to determine the Q point. 05
- Q.6B Consider Four resistor Bias Circuit for MOSFETs, $V_{DD} = 5 \text{ V}$, $R_1 = 17 \text{ K}\Omega$, $R_2 = 33 \text{ K}\Omega$, $R_D = R_S = 16 \text{ K}\Omega$, $V_{TN} = 1 \text{ V}$, $k_N' = 40 \mu\text{A/V}^2$, $W = 10 \mu\text{m}$, $L = 1 \mu\text{m}$. Determine the Quiescent Drain current. 05
- OR
- Q.6B Draw the circuit diagram of potential divider biasing circuit For BJT. Write the mathematical equations to determine the Q point. 05
- Q.7A Draw the circuit diagram of differential amplifier. Define CMRR. 05
- Q.7B Draw the small signal model of MOSFET and write the mathematical equation for trans -conductance. 05
- OR
- Q.7B Draw the small signal model for BJT .Write mathematical equations for Capacitances and resistances involved in the model. 05

- Q.8 Determine the total output voltage for the amplifier whose input signal is $0.1 \sin \omega t$. 10
A



- Q.9A Draw the High frequency model of BJT and explain the internal capacitances 10
Q.9B Draw the frequency response of BJT and explain why the response degrades at lower and higher frequencies. 10
- OR
- Q.9B Explain Miller's theorem and determine equivalent input capacitance for BJT high frequency model. 10