

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination November 2018

B. Tech Electrical/ECE Engineering, Semester III

Roll No.....

COURSE CODE: ECE 311

Time: 3 hours

Max. Marks: 80

COURSE TITLE: Electronic Devices & Circuits

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. When semiconductor is doped with impurities following change occurs
Mobility increases (B) Resistivity increases (C) Conductivity Increases (D) All of above
- ii. Two initially identical samples A and B of pure germanium are doped with donors to concentration of $1 \times 10^{20} \text{ m}^{-3}$ and $3 \times 10^{20} \text{ m}^{-3}$, respectively. If the hole concentration in A is $9 \times 10^{12} \text{ m}^{-3}$, then the hole concentration in B is
(A) $3 \times 10^{12} \text{ m}^{-3}$ (B) $7 \times 10^{12} \text{ m}^{-3}$ (C) $11 \times 10^{12} \text{ m}^{-3}$ (D) $27 \times 10^{12} \text{ m}^{-3}$
- iii. A heavily doped semiconductor diode is reverse biased such that very large reverse current is observed. The likely cause for the large current is
(A) Breakdown by field ionization (B) Breakdown by impact ionization
(C) Short circuit within diode (D) None of above
- iv. A diode has forward current of $2 \mu\text{A}$ flowing through it. The small signal diode resistance r_D is (A) $1.3 \text{ K}\Omega$ (B) $13 \text{ K}\Omega$ (C) $130 \text{ K}\Omega$ (D) 130Ω
- v. 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
- vi. Voltage-shunt feedback stabilizes
(A) Voltage gain (B) Current gain (C) Trans-resistance (D) Transconductance
- vii. Channel is formed in MOSFET when the device is in
Accumulation Mode (b) Depletion Mode (C) Inversion Mode (D) Forward Active Mode
- viii. The trans conductance of MOSFET g_m can be increased by
Decreasing aspect ratio (B) increasing drain current I_D (C) decreasing overdrive V_{GT} (D) increasing output resistance
- ix. Class A amplifier directly coupled has to supply 10 Watts output to a load. The power dissipation in the amplifier will be
 10 W (b) 20 W (c) 40 W (d) 80 W
- x. The class AB push pull amplifier has major advantage of reducing
(A) Power consumption (B) number of transistors
(C) output resistance (D) cross over distortion

- Q.2 Short answer type questions (4 questions @ 2.5 marks) 10
- A What is Diffusion? Write expression for diffusion current in semiconductor.
- B What is built-in potential of pn junction. Write mathematical expression for V_{bi} .
- C Draw the schematic diagram of npn Bipolar junction transistor showing various current components under reverse bias.
- D Draw the output characteristics of a typical MOSFET, marking the regions of operation.

- Q.3A Explain how carrier concentration changes in semiconductor when it is heated. 05
- Q.3B Define Mobility. Assume that a semiconductor has only one scattering mechanism with a relaxation time of 0.2ps. Determine the electron mobility in this sample. Assume effective mass of electron as $0.5 \cdot m_0$ where m_0 is the free mass of electron and is 9.1×10^{-31} kg. 05

- Q.4A If fermi level in Silicon is 0.20 eV above the valence band what will be the values of n_0 and p_0 for Si at $T=300K$. Given $N_C = 2.8 \times 10^{19} \text{ cm}^{-3}$ and $N_V = 1.04 \times 10^{19} \text{ cm}^{-3}$. 05

- Q.4B Explain Hall effect measurement setup and how can it be used to find the type of semiconductor. 05

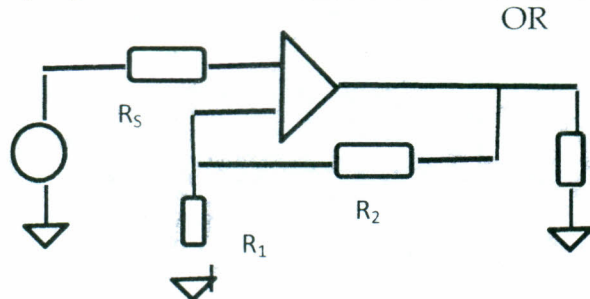
- Q.5A Draw the small signal model of BJT and write expression for trans conductance. A BJT with $\beta = 100$ is biased at dc collector current of 1 mA. Find g_m . 05

- Q.5B Explain Early voltage and show the voltage on BJT output characteristics. 05

- Q.6A What are advantages of negative feedback? Explain any one advantage in detail. 05

- Q.6B Draw a table showing comparison of the four types of feedback amplifiers and their properties. 05

- Q.6B 05



In the Figure 6(b), the amplifier has infinite input resistance and zero output resistance. Find the feedback factor β . If the amplifier has open loop gain of 10^4 , find the R_2/R_1 so as to achieve closed loop gain equal to 10 for the feedback amplifier.

- Q.7 Explain the device structure of N channel MOSFET. Derive the current for MOSFET operating in Triode region. 10

- Q.8 Explain the classification of Output Stage Amplifiers with diagram of waveforms after amplification as well as location of Quiescent points on output characteristics. 10

OR

- Q.8(B) Draw the circuit diagram of class B pushpull amplifier and show that maximum efficiency of this configuration is 78.5% 10