Sub Code:REC302

Paper Id: 130302 Roll No: | | | | | | | | | | | | |

B. TECH
(SEM-III) THEORY EXAMINATION 2019-20
ELECTRONIC DEVICES & CIRCUITS

Time: 3 Hours ***Total Marks: 70***

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. 2 x 7 = 14

(a) For NMOS transistor, write the drain current expression for all its region.
(b) Draw T model of n-channel MOSFET incorporating output resistance.
(c) What do you mean by feedback? Give its types.
(d) Give the Barkhausan conditions to obtain sustained oscillations.
(e) Draw Ebers Moll model for NPN transistor.
(f) What do you mean by Fermi level?
(g) What do you mean by Excess Carrier?

SECTION B

2. Attempt any *three* of the following: 7 x 3 = 21

(a) Describe the construction, operation and characteristics of N-channel enhancement MOSFET. Describe the role of substrate (the body effect) in MOSFET.
(b) Draw the circuit diagram of single stage CE amplifier, implement hybrid π model and T model for it and calculate expression for i_e , g_m , i_b .
(c) Explain the merits and demerits of negative feedback. Also explain in brief the various topologies used in negative feedback.
(d) Differentiate between direct and indirect bandgap semiconductor.
(e) A new semiconductor has $N_C = 10^{18}$ cm^{-3}, $N_V = 5x10^{17}$ cm^{-3} and $E_g = 2ev$. If it is doped with 10^{16} donors(fully ionized), calculate the electron, hole and intrinsic carrier concentration at 627°C. Sketch the simplified band diagram, showing the position of E_F. (Take $k = 8.625x10^{-5}$ eV/K).

SECTION C

3. Attempt any *one* part of the following: 7 x 1 = 7

(a) Describe Optical Absorption.
(b) Write a note on **any one** (i) Carrier lifetime (ii) Fermi level

4. Attempt any *one* part of the following: 7 x 1 = 7

(a) What is a p-n junction? Describe properties of an equilibrium p-n junction with the help of a diagram.
(b) Write the short note on Photodiode and Solar Cell

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5. **Attempt any *one* part of the following:** **7 x 1 = 7**

   (a) Discuss a common- source amplifier, draw its ac equivalent circuit and obtain expression for its terminal characteristics.

   (b) Calculate the MOSFET Unity-Gain frequency (f_T) with the help of MOSFET high frequency model.

6. **Attempt any *one* part of the following:** **7 x 1 = 7**

   (a) Explain the working of BJT as an amplifier and as a switch with the help of neat diagram and necessary equations. Also calculate the amplifier gain.

   (b) Discuss the various internal capacitances for BJT. A particular small geometry BJT has f_T of 5 GHz and C_μ = 1pF when opertated at I_C = 0.5mA. What is C_π in this situation. Also find g_m. For β = 150, find r_π and f_β.

7. **Attempt any *one* part of the following:** **7 x 1 = 7**

   (a) Design a series – shunt feedback amplifier and derive expressions for A_f , R_{of} and R_{if}.

   (b) For the Colpitt's oscillator, derive an expression for the frequency of oscillation.

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