2019

MSc

2nd Semester Examination

ELECTRONICS

PAPER – ELC-202

Full Marks: 50

Time: 2 Hours

The figures in the right-hand margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Illustrate the answers wherever necessary.

GROUP-A THEORY

1. ANSWER ANY ***FOUR*** QUESTIONS. (2x4)

i) What is diffusion capacitance?
How does it different from depletion capacitance?

ii) Explain the operating principle of a varactor diode.

iii) What do you mean by neutral level in connection with a metal semi conductor junction?

iv) Derive the expression of pinch-off voltage of a MESFET.

v) What do you mean by Gummel number of a BJT?

vi) Name the extrinsic and intrinsic small signal parameters of a field effect transistor.

vii) Draw the LFCV and HFCV plot of a M-I-S DIODE and explain its nature of variation.

viii) Discuss some short channel effects of MOSFETS.

GROUP B

2. **ANSWER ANY *FOUR* QUESTIONS.**

i) Write a neat sketch discuss the mechanisms of field ionization and Input ionization associated with a P-N junction diode. 4

ii) Derive the expression of built-in-potential of a P-N junction diode. 4

iii) Draw the Ebers-Moll model of a P-N-P transistor and derive the expressions of emitter, collector and base current. 4

iv) For a metal semi conductor junction prove that $q(\phi_{bn} + \phi_{bp}) = E_g$ where the symbols have their usual meaning. 4

v) Explain how can you measure the barrier height of a metal- semi conductor Using (I) current voltage measurement method and (ii) Activation energy Measurement method . 2+2

vi) For a metal semiconductor field effect transistor operated under electron velocity saturation prove that $g_m / C_{gs} = V_s z$, where the symbols have their usual meaning.

vii) Prove that in a SCR

$$I_A = \frac{\alpha_2 Ig + Ico_1 + Ico_2}{1-(\alpha_1 + \alpha_2)}$$

Where the symbols have their usual meaning. 4

viii) Show that saturation drain current of a MOSFET is given by $I_{Dsat} = \frac{mz}{L} \mu_n C_i (V_G - V_T)^2$ Where the symbols have their usual meaning.

GROUP C

3. ANSWER ANY ***TWO*** QUESTIONS.

i) Prove that in a MESFET drain conductance in lenear region in same as one mutual conductance in the saturation region. 8

ii) Prove that in case of a metal semi conductor junction current density

$$J = A^{*}T^{2}e^{-q\frac{\phi bn}{x^{2}}}\left(e^{\frac{qv}{x^{2}}}-1\right)$$

Where the symbols have their usual meaning. 8

iii) Derive the expression of built –in –potential depletion layer width and junction capacitance of a linearly graded P-N Junction. 8

iv) Show that in a M-I-S DIODE the differential depletion capacitance C_D is given by 8

$$C_D = \frac{\epsilon_s}{\sqrt{2L_D}} \frac{\left[1 - e^{-\beta\psi_s} + \frac{nPo}{Ppo}\left(e^{\beta\psi_s}-1\right)\right]}{F\left(\beta\psi_s \quad \frac{nPo}{Ppo}\right)}$$

Where the symbols have their usual meaning. 8

(Internal assessment -10 marks)