Reg.No. \_\_\_\_\_\_\_\_\_\_\_\_



**End Semester Examination – Nov/Dec – 2018**

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| **Code :** | **18EC3028** | **Duration :** | **3hours** |
| **Sub. Name :** | **SOLIDSTATE DEVICE MODELING AND SIMULATION** | **Max. marks :** | **100** |

**ANSWER ANY FIVE QUESTIONS (5 x 16 = 80 Marks)**

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| **Q. No.** | **Sub Div.** | **Questions** | **Course**  **Outcome** | **Marks** |
| 1. | a. | Explain the drift current, diffusion current components of semiconductors | CO1 | 8 |
| b. | Write a comparative analysis of band and bond models of solids | CO1 | 4 |
| c. | Obtain the continuity equation for the current flow in a semiconductor | CO1 | 4 |
|  |  |  |  |  |
| 2. | a. | Draw the energy band of a CE npn transistor | CO2 | 4 |
| b. | Derive the expression for base transport factor and obtain the Ebers-Moll model of BJT | CO2 | 12 |
|  |  |  |  |  |
| 3. | a. | Assess the effects of VBC NPN transistor and derive ideal voltage – current characteristics | CO2 | 10 |
|  | b. | Obtain the basic small signal model of npn transistor | CO2 | 6 |
|  |  |  |  |  |
| 4. | a. | Apply the equilibrium electron - hole statistics of MOS Capacitor and derive the Poisson-Boltzmann equations with boundary conditions | CO3 | 10 |
|  | b. | Brief the operating modes of MOS capacitor and plot its ideal low and high frequency characteristics | CO3 | 6 |
|  |  |  |  |  |
| 5. | a. | With neat expressions, obtain the drain current equation of long-channel MOST using forward and reverse currents | CO3 | 10 |
|  | b. | Validate the MOSFET parameters channel length modulation, Short-channel effect, and velocity saturation Using the MOST short channel model calculate VDsat and IDsat for the parameters xox=20nm, W=50µm, L=0.5 µm, VT=0.7V, VGS=3V, and VDS=1.5V | CO3 | 6 |
|  |  |  |  |  |
| 6. | a. | Derive and explain the low frequency small-signal transconductance model of long-channel MOSFET | CO4 | 10 |
|  | b. | Brief the model of inversion capacitance in MOST | CO4 | 6 |
|  |  |  |  |  |
| 7. | a. | With neat mathematical expressions, derive the Pao-Sah current - voltage model of MOST | CO5 | 10 |
|  | b. | Draw the energy band of MOST and write the surface potential master equation | CO5 | 6 |
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| **COMPULSORY QUESTION (1 x 20 = 20 Marks)** | | | | |
| 8. | a. | Narrate various MOSFET scaling processes in detail | CO6 | 15 |
|  | b. | Brief the quantum effect on MOSFET threshold voltage | CO6 | 5 |