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



**UNIVERSITY**

(Karunya Institute of Technology & Sciences)

(Declared as Deemed-to-be University under Sec.3 of the UGC Act, 1956)

**End Semester Examination – Nov/Dec – 2016**

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|  |  | **Semester :** | **2016-17 ODD** |
| **Code :** | **14EC3023** | **Duration :** | **3hrs** |
| **Sub. Name :** | **SOLID STATE DEVICE MODELING AND SIMULATION** | **Max. marks :** | **100** |

**ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)**

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| Q. No. | Sub Div. | Questions | Course  Outcome | Marks |
| 1. |  | Discuss the work function and flat band voltage of MOS capacitor when no external voltage is applied. | CO1 | 20 |
| (OR) | | | | |
| 2. | a. | An n-channel silicon MOSFET (NMOS) has the following construction: The p-type substrate doping is NA = 5 x 1016 1/cm3. The n-type polysilicon gate is doped at ND = 1019 1/cm3. The gate length is 0.5 µm. The oxide thickness tox =20 nm. The device width is 20 µm. The source and drain are doped degenerately (very highly) at ND = 1020 1/cm3.The source and drain regions are each 1µm wide and 0.25 µm deep. The p-type bulk (substrate) is 100 µm deep. Silicon dioxide and silicon permittivity are єox =3.9 x 8.9x10-14 F/cm and єsi = 11.7x8.9x10-14 F/cm. ni = 1.45 x 1010 1/cm3, µn =500 cm2/V. sec. Assume room temperature, so that KT/q = 0.026V.  Draw the band diagram with no bias applied to the substrate. Then calculate the threshold voltage Vth under that condition. | CO2 | 15 |
| b. | Derive an expression for transconductance of a MOSFET. | CO1 | 5 |
| 3. |  | Derive an expression for threshold voltage for a non-uniformly doped substrate MOSFET. | CO1 | 20 |
| (OR) | | | | |
| 4. |  | Discuss the Velocity Saturation Model and Capacitance Models of a MOSFET. | CO1 | 20 |
| 5. |  | Explain the modeling of the Intrinsic and extrinsic Components of high-frequency applications. | CO2 | 20 |
| (OR) | | | | |
| 6. | a. | With an equivalent circuit name the noise sources in a MOSFET. | CO1 | 5 |
|  | b. | How will you extract parameters using Y-parameter analysis. | CO1 | 15 |
| 7. |  | Discuss the threshold voltage model for Nonuniform Lateral Doping due to Pocket (Halo) Implant and improved threshold voltage model for Short-channel Effects. | CO2 | 20 |
| (OR) | | | | |
| 8. |  | Discuss mobility model and source/drain resistance model of a MOSFET. | CO2 | 20 |
|  | | **Compulsory:** |  |  |
| 9. |  | Discuss the noise Model of a MOSFET in detail. | CO2 | 20 |