**BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI**

**HYDERABAD CAMPUS**

#### FIRST SEMESTER 2019‑2020

# **Course Handout Part II**

### 01/08/2019

In addition to part ‑I (General Handout for all courses appended to the Time Table), this portion gives further specific details regarding the course.

Course No. : EEE F214 / ECE F214/ INSTR F214

Course Title : Electronic Devices

Instructor‑in‑Charge : Souvik Kundu

Lecture Instructors : Souvik Kundu & Sayan Kanungo

Tutorial Instructors : Souvik Kundu, Ramakant Jadav, Michael Preetam Raj

and Pavan Kumar Reddy

**1. Scope and Learning Outcome:**

1. Understanding the relationship between atomic structure and physical properties of semiconductors.
2. Interpreting electronic band structure using quantum mechanics.
3. Identifying the semiconductor properties that determine the performance of electronic devices.
4. Calculating the carrier concentrations and conductivity of a semiconductor using given doping concentrations.
5. Understanding the basic physics of charge carriers in solids and carrier transport in semiconductors.
6. Deriving equations of charge transport in semiconductors under normal operating conditions.
7. Applying the charge diffusion equation to electronic devices and deriving their I-V characteristics.
8. Utilizing defect densities and carrier recombination processes to calculate generation and recombination rates in semiconductor devices.
9. Understanding the basics of optoelectronic devices.

**2. Text Book:**

B. G. Streetman, and Sanjay Banerjee, “Solid State Electronic Devices”, 6th Ed., PHI, 2006

**3. Reference Book:**

D A. Neaman, “Semiconductor Physics and Devices”, 4e, Tata Mc Graw Hill.

**4. Course Plan:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Lecture No.** | **Topics to be covered** | **Learning Outcomes** | **Chapter in the Text Book** |
| 1 | Introduction to the subject and course details |  |  |
| 2-5 | Review of semiconductor fundamentals. | Fundamentals of quantum physics, Schrödinger wave equation, tunneling, uncertainty principle, KP model. | 3.1.3, 3.1.4, 3.2 |
| 6-8 | Crystal Structure | Cubic Lattices, Planes & Directions | 1.2.1 – 1.2.3 |
| 9-11 | Charge carriers in semiconductors, | Fermi level, Density of states, equilibrium carrier concentrations, temperature dependence, space charge neutrality | 3.3 |
| 12-14 | Effect of electric and magnetic fields on drift of carriers | Conductivity and mobility, Hall effect | 3.4-3.5 |
| 15-19 | Excess carriers in semiconductors | Interaction of photons with semiconductors, generation and recombination mechanisms of excess carriers, quasi-fermi levels in non- equilibrium | 4.1 – 4.4 |
| 20-27 | Junctions | PN junctions, I-V characteristics, biasing, breakdown diodes, Metal semiconductor junctions, Tunnel Diode, Varactor diode | 5.2 – 5.7, 10.1 |
| 28-32 | Field Effect Transistors | To understand the structure and working of JFET, MOSFET, I-V characteristics and secondary effects | 6.2,6.3.1,6.3.3, 6.4.1-6.4.5, 6.5.1-6.5.4, 6.5.6,6.5.8 |
| 33-38 | Optoelectronic devices | Photoelectric effect, Solar cells, Photodiodes, Light Emitting Diodes(LED), Lasers and Semiconductor Lasers | 2.2.1, 8.1–8.4 |
| 39-42 | Bipolar Junction Transistors | BJT operations, amplifications, carrier distribution, I-V characteristics etc. and secondary effects, | 7.1, 7.3 –7.7, 7.9 |

**5. Evaluation Scheme:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Component** | **Duration** | **Weightage** | **Marks (200) (%)** | **Date & Time** | **Nature of Component** |
| Mid-Sem | 90 min | 30% | 60 | 4/10, 11.00 -- 12.30 PM | Closed Book |
| Open Book Quiz | 50 min | 25% | 50 | To be announced in class | Open Book |
| Comprehensive Exam. | 3 hours | 45% | 90 | 11/12 AN | Closed Book |
| Total | | 100% | 200 |  |  |

**6.** **Chamber Consultation hours**: To be announced in the class.

**7.** **Notices**: All notices for the course will be announced in the class and displayed only on the CMS.

**Make-up Policy:** Requests for make-up examination will be entertained ONLY for extremely serious cases where:

i) Written & signed documentary evidence needs to be provided from the Hostel Warden confirming the reason for absence from scheduled examination

(ii) In case of medical emergencies, students must produce a documentary evidence from the surgeon and hostel warden.

**Academic Honesty and Integrity Policy**:

Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

**Instructor‑in‑Charge**

**Souvik Kundu**