

**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:**

- i. Understanding the relationship between atomic structure and physical properties of semiconductors.
- ii. Interpreting electronic band structure using quantum mechanics.
- iii. Identifying the semiconductor properties that determine the performance of electronic devices.
- iv. Calculating the carrier concentrations and conductivity of a semiconductor using given doping concentrations.
- v. Understanding the basic physics of charge carriers in solids and carrier transport in semiconductors.
- vi. Deriving equations of charge transport in semiconductors under normal operating conditions.
- vii. Applying the charge diffusion equation to electronic devices and deriving their I-V characteristics.
- viii. Utilizing defect densities and carrier recombination processes to calculate generation and recombination rates in semiconductor devices.
- ix. Understanding the basics of optoelectronic devices.

**2. Text Book:**

B. G. Streetman, and Sanjay Banerjee, “Solid State Electronic Devices”, 6<sup>th</sup> 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**