Solid State Electronic Devices

1.1 Course Number: ECE231

1.2 Contact Hours: 3-1-0 Credits: 11

1.3 Semester-offered: 2nd Year-Odd

1.4 Prerequisite: Fundamental of Electronics Engineering

1.5 Syllabus Committee Member: Dr. Umakant Dhar Dwivedi, Dr. Amarish Dubey, Dr. Sajal Agarwal, Dr. Abhishek Kumar Singh, Dr. Shivanshu Shrivastava.

2. Objective: The course is an introduction to semiconductor fundamentals and applications to electronic devices. The course creates the background in the physics of compound semiconductor-based electronic devices and prepares students to advanced courses in electronics engineering.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-topic	Lectures
1	Electronic levels in semiconductors	Evolution and uniqueness of Semiconductor Technology, Equilibrium carrier concentration, Bond and Band models for Intrinsic semiconductor & Extrinsic semiconductor.	10
2	Charge Transport Mechanism	Carrier transport Random motion Drift and diffusion, Excess carriers Injection level Lifetime Direct and indirect semiconductors	05
3	Device Analysis	Procedure for analyzing semiconductor devices Basic equations and approximations	02
4	PN Junction diodes:	Device structure and fabrication Equilibrium picture DC forward and reverse characteristics Small-signal equivalent circuit Switching characteristics Solar cell	07
5	MOS Capacitor	MOS Junction C-V characteristics, threshold voltage, body effect, Parameter extraction	03
6	MOSFET	Metal Oxide Field Effect Transistor History Device structures and fabrication Common source DC characteristics Small-signal equivalent circuit, Differences between a MOSFET and a BJT, Junction FET and MESFET, Recent Developments Heterojunction FET	13

		Heterojunction bipolar transistor, Power MOSFET, Insulated Gate Bipolar Transistor and their applications	
		Total	**40**

4. READINGS

4.1 TEXTBOOKS:

1. R. F. Pierret, Field Effect Devices (Vol. 4 of the Modular Series on Solid State Devices, Addison-Wesley, Reading, MA, 1990).
2. M. Shur, Physics of Semiconductor Devices (Prentice-Hall, Englewood Cliffs, NJ, 1990).
3. D. A. Neaman, Semiconductor Physics and Devices (Irwin, Boston, MA, 1997).
4. E. H. Nicollian and J. R. Brews, MOS Physics and Technology (Wiley, New York, 1982).
5. M. Zambuto, Semiconductor Devices (McGraw-Hill, New York, 1989).

4.2 REFERENCE BOOKS:

1. B. G. Streetman and S. Bannerjee, Solid State Electronic Devices (Prentice Hall, Englewood Cliffs, NJ, 2000).

2. S. M. Sze, Physics of Semiconductor Devices (Wiley, New York, 1981).

5. OUTCOME OF THE COURSE: A strong foundation for better understanding of Courses to be taught in subsequent semesters.