SEMESTER S8

POWER SEMICONDUCTOR DEVICES

Course Code	**PEEVT 862**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	**ESE Marks**	60
Credits	3	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	PCEVT503 VLSI Technology	**Course Type**	Elective

Course Objectives:

1. To introduce the fundamental concepts and historical evolution of high-power circuit design, emphasizing power levels, efficiency, and thermal considerations in various industrial applications.
2. To provide an understanding of high-power design methodologies, focusing on techniques for optimizing efficiency and reliability in circuits, and in-depth knowledge of power semiconductor devices such as MOSFETs and IGBTs
3. To equip students with the principles and design considerations for high-frequency converters and power amplifiers, including effective thermal management strategies for high-power systems.
4. To explore real-world applications and case studies of high-power circuit designs, and to investigate advanced topics and emerging trends to enhance efficiency and reliability in high-power systems.

SYLLABUS

Module No.	**Syllabus Description**	**Contact Hours**
1	Introduction to High Power Circuit Design: Overview of the importance of high-power circuit design in various industries, Historical context and evolution of high-power technologies, Introduction to key concepts: power levels, efficiency, and thermal considerations.	**9**
2	Design Methodologies for High Power Applications: Principles of high-power design methodologies, Techniques for optimizing efficiency and reliability in high-power circuits. Power Semiconductor Devices and Applications: In-depth study of power semiconductor devices (MOSFETs, & IGBTs). Applications of power	**9**

	devices in high-power circuits.	
3	High-Frequency Converters and Power Amplifiers: Principles of high-frequency converters and power amplifiers, Design considerations and challenges in high-frequency power conversion. Thermal Management in High Power Systems: Principles of thermal management for high-power circuits, Heat dissipation strategies and thermal modelling.	**9**
4	Applications of High-Power Circuit Design: Real-world applications of high-power circuit designs. Case studies: Analysing successful high-power system implementations. Advanced Topics and Emerging Trends in High Power Design: Emerging trends in high-power circuit design, Advanced components and techniques for achieving higher efficiency and reliability.	**9**

Course Assessment Method
(CIE: 40 marks , ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination-2 (Written)	Total
5	**15**	**10**	**10**	**40**

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Understand the significance of high-power circuit design, including its historical evolution, key concepts such as power levels, efficiency, and thermal considerations relevant to various industries.	**K2**
CO2	Apply design methodologies for high-power applications, optimizing efficiency and reliability by understanding the principles and techniques associated with power semiconductor devices like MOSFETs and IGBTs.	**K3**
CO3	Design and analyse high-frequency converters and power amplifiers, addressing design considerations and challenges, and implement effective thermal management strategies for high-power systems.	**K4**
CO4	Evaluate real-world applications of high-power circuit design through case studies, and explore advanced topics and emerging trends to enhance efficiency and reliability in high-power circuit implementations	**K5**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**2**	**1**	**1**	**1**			**1**	**1**		
CO2	**3**	**2**	**3**	**2**	**1**	**1**			**1**	**1**		
CO3	**3**	**3**	**3**	**2**	**3**	**1**			**1**	**1**		
CO4	**3**	**3**	**3**	**3**	**1**	**1**			**1**	**1**		

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Fundamentals of High-Frequency CMOS Analog Integrated Circuits.	Duran Leblebici, Yusuf Leblebici	Cambridge	2009
2	High-Frequency Integrated Circuits	Sorin Voinigescu	Cambridge	2013
3	The Design of CMOS Radio-Frequency Integrated Circuits	Thomas H. Lee	Cambridge	2003

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Transmission Lines: Equivalent Circuits, Electromagnetic Theory, and Photons	Richard Collier	Cambridge University Press	2013
2	Dynamic Power Supply Transmitters: Envelope Tracking, Direct Polar, and Hybrid Combinations	Earl McCune	Cambridge University Press	2015
3	RF Circuit Design	Ludwig	Pearson	2011

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://archive.nptel.ac.in/courses/117/106/117106089/
2	www.digimat.in/nptel/courses/video/108108112/
3	https://archive.nptel.ac.in/courses/108/102/108102157/
4	https://archive.nptel.ac.in/courses/117/106/117106089/