POWER ELECTRONICS

V-Semester: EEE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AEEB20	Core	2	1	--	3	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The students will try to learn:

I. The concepts on power semiconductor devices related to its characteristics, ratings, and protection to select these devices for various applications.
II. The fundamental principles and control techniques of power electronic converters for analyzing AC/DC, DC/DC, AC/AC and DC/AC power conversion circuits.
III. The application of power electronic converters in the fields of battery management system, industrial drive applications and enhancement of power quality.

COURSE OUTCOMES:

1. Explain the static and dynamic characteristics of power semiconductor devices used for power conversion in converter circuits.
2. Select series or parallel connection of SCRs to enhance power handling capacity in real time applications.
3. Summarize the various firing circuits and commutation techniques useful for minimizing switching losses of SCRs.
4. Demonstrate the working principle of thyristor based ac-dc converters and calculate the performance parameters under various load conditions.
5. Examine the effect of source inductance on the rectifier output while assessing the performance of converters.
6. Identify the switching techniques and control strategies of chopper circuit for regulating dc power and perform steady state analysis.
7. Analyze single phase ac voltage controllers used for converting fixed ac supply into variable ac output at constant frequency.
8. Explain the operating principle of single phase cyclo converter to modulate the frequency of input waveform.
9. Apply modulation and switching techniques for output voltage control of single phase and three phase inverters.
10. Design, simulate and build efficient power conversion systems for given specifications as a member in a team or alone and interpret the results obtained.

MODULE-I POWER SWITCHING DEVICES

Diode, Thyristor, MOSFET, IGBT: I-V Characteristics; R, RC and UJT firing circuit for thyristor; Gate drive circuits for MOSFET and IGBT. Series and parallel operation, ratings, protection against dv/dt and di/dt, design of Snubber circuit, forced commutation circuits, other devices in thyristor family: TRIAC, GTO and their characteristics, numerical problems.

MODULE-II	PHASE CONTROLLED RECTIFIERS
Single phase half wave and single phase full bridge thyristor rectifier with R- load and highly inductive load; derivation of average load voltage and current, effect of freewheeling diode, effect of source inductance, Three phase full bridge thyristor rectifier with R-load and highly inductive load; Dual converters, circulating and non-circulating current modes of operation of single phase and three phase dual converters with R-Load, numerical problems.	
MODULE-III	**CHOPPERS**
Basic chopper operation, control strategies, step up chopper, derivation of load voltage and load currents with R and RL loads, chopper configurations. Power circuit of a buck, boost and buck-boost converters: Analysis and waveforms at steady state.	
MODULE-IV	**AC VOLTAGE CONTROLLER AND CYCLO CONVERTERS**
Single phase AC voltage controllers - two SCRs in anti-parallel with R and RL loads, derivation of rms load voltage and load current, numerical problems, Cyclo converters - single phase midpoint and bridge type (step-up and step-down operations) with R and RL loads.	
MODULE-V	**INVERTERS**
Single phase inverters: Basic operation, voltage source inverters, basic series and parallel inverters, current source inverter, modified Mc Murray and Mc Murray-Bedford half bridge inverters (operation and waveforms), voltage control by pulse width modulation techniques (single pulse, multiple pulse and sinusoidal), numerical problems. Three phase bridge Inverters - 180^o and 120^o conduction modes of operation.	

TEXTBOOKS:

1. Dr. P S Bimbhra, "Power Electronics", Khanna Publishers, Delhi, 4th Edition, 2008.
2. M H Rashid, "Power electronics: circuits, devices, and applications", Pearson Education India, 3rd Edition, 2009.

REFERENCE BOOKS:

1. L Umanand, "Power Electronics: Essentials and Applications", Wiley India, 3rd Edition, 2009.
2. N Mohan and T M Undeland, "Power Electronics: Converters, Applications and Design", John Wiley & Sons, 2nd Edition, 2007.
3. R. W. Erickson and D Maksimovic, "Fundamentals of Power Electronics", Springer Science & Business Media, 2nd Edition, 2007.

WEB REFERENCES:

1. https://www.coursera.org/learn/power-electronics
2. https://nptel.ac.in/courses/108/102/108102145/
3. https://www.electronicsforu.com/videos-slideshows/power-electronic-devices
4. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-334-power-electronics-spring-2007/lecture-notes/

E-TEXT BOOKS

1. https://b-ok.asia/book/3555381/8d9744
2. https://b-ok.asia/book/2360651/a55c20
3. https://b-ok.asia/book/668728/9083c3