

ADVANCED POWER ELECTRONICS
(Professional Elective-V)**Pre Requisite:** Power Electronics, Electrical Circuits.**Course Objectives:**

1. To understand the operation of advanced power electronic topologies.
2. To understand various configurations of converters.
3. To analyze various power converters and identify their applications.
4. To understand operation of Switched mode power supplies.

Unit -I: (~8 Lecture Hours)**Advanced Power Semiconductor Devices** - Basic structure and operation of : MOS Turn Off Thyristor (MTO) - Emitter Turn Off Thyristor (ETO) - Integrated Gate Commutated Thyristor (IGCT) - MOS Controlled Thyristor (MCT) - Gate turn Off Thyristor (GTO) - Comparison of devices.**Unit-II: (~10 Lecture Hours)****Switch mode power supplies:****DC Power supplies-** Fly back Converter-Forward converter- Push-Pull converter- Half bridge converter-Full Bridge Converter-Resonant DC power supplies-Bidirectional power supplies-Applications.**AC power supplies-** Resonant AC power supplies-bidirectional AC power supplies-UPS**Unit-III: (~9 Lecture Hours)****Resonant Inverters** :Series resonant inverters with unidirectional and bidirectional switches - Analysis of resonant inverter with bidirectional switches-half bridge and full bridge topology - Frequency response of series resonant inverters- for series loaded, parallel loaded and series-parallel loaded - Parallel resonant inverters- Numerical problems.**Unit-IV: (~8 Lecture Hours)****Resonant Converters:** Zero Current Switching (ZCS) resonant converters- L type and M type ZCS resonant converter - Zero Voltage Switching (ZVS) resonant converters - Comparison between ZCS and ZVS resonant converters- Two quadrant ZVS resonant converters- Resonant dc link inverters-Evaluation of L and C for ZCS inverter- Numerical Problems.

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Unit -V : (~ 10 Lecture Hours)

Multi-level Inverters(MLI): Multi level concept, Classification of Multi Level Inverters. Principle of operation and main features of Diode clamped Multi Level Inverters, Cascaded Multi Level Inverters and Flying Capacitor Multi Level Inverters(limited to three level inverters only), Comparison of MLIs.
Pulse Width Modulation (PWM) Techniques: Sinusoidal PWM(SPWM), Harmonic Injection PWM, Space Vector Pulse Width Modulation (SVPWM), Hysteresis controller.

Text Books :

1. Muhammad H. Rashid , "Power Electronics: Devices, circuits and Applications", Pearson Education, 4th Edition- 2017.
2. Ned Mohan, Tore M. Undeland and Willilam P. Robbins, "Power Electronics", John Wiley and sons, 3rd Edition -2002.
3. P.S. Bimbra, "Power Electronics", Khanna Publishers, 4th Edition -2018.

Reference Books:

1. M.D. Singh and K.B. Khanchandani , "Power Electronics", Mc Graw Hill companies, 2nd Edition - 2008.
2. G.K.Dubey, S.R. Doradla, A. Joshi, R.M.K. Sinha, "Thyristorised Power Controllers", New Age International Publishers, 1st Edition - 2005.
3. NPTEL Video Courses - https://onlinecourses.nptel.ac.in/noc19_ee15, <http://www.nptelvideos.in/2012/11/power-electronics.html>.

Course Outcomes:

Subsequent to completion of the course, the student will be able to:

1. Acquire knowledge about analysis and design of various converter topologies Viz. DC- DC converters, Resonant Inverters and Resonant converters.
2. Analyze various Multi Level Inverter topologies.
3. Analyze various Switch Mode Power Supplies.
4. Choose an appropriate converter topology for a particular application.
5. Choose a suitable control technique for a given application.
6. Apply knowledge acquired to increase the level of inverters.

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