Type of course: Engineering

Prerequisite: Power Electronics-I (2150903) and Power Electronics-II (2160902)

Rationale: The course is aimed to provide exposure of some power electronic converters that are utilized by the industries and utilities and are not taught in the basic courses on Power Electronics-I and Power Electronics-II.

Teaching and Examination Scheme:

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<tr>
<th>Teaching Scheme</th>
<th>Credits</th>
<th>Examination Marks</th>
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Content:

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<th>Sr. No.</th>
<th>Content</th>
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<tbody>
<tr>
<td>1</td>
<td>Switching Voltage Regulators</td>
<td>10</td>
<td>24</td>
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<td>Introduction; Linear power supply (voltage regulators); Switching voltage regulators; Review of basic dc-dc voltage regulator configurations -Buck, Boost, Buck-Boost converters and their analysis for continuous and discontinuous mode; Other converter configurations like Flyback converter, Forward converter, Half bridge, Full bridge configurations, Push-pull converter, C'uk converter, Sepic Converter; Design criteria for SMPS; Multi-output switch mode regulator</td>
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<td>2</td>
<td>Resonant Converters</td>
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<td>17</td>
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<td>Introduction, Need of resonant converters, Classification of resonant converters, Load resonant converters, Resonant switch converters, zero-voltage switching dc-dc converters, zero current switching dc-dc converters, clamped voltage topologies</td>
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<td>Multi-level Converters</td>
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<td>Need for multi-level inverters, Concept of multi-level, Topologies for multi-level: Diode Clamped, Flying capacitor and Cascaded H-bridge multilevel Converters configurations; Features and relative comparison of these configurations applications, Introduction to carrier based PWM technique for multi-level converters</td>
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<td>4</td>
<td>Multipulse Converters</td>
<td>5</td>
<td>11</td>
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### Reference Books:

8. L. Umanand, “Power Electronics Essentials and Applications”, Wiley India Ltd., 2009
9. Recent Literature

### Course Outcome:

After learning the course the students should be able to:

- Evaluate different dc-dc voltage regulators
- Simulate and analyze resonant converters
- Select appropriate phase shifting converter for a multi-pulse converter
- Evaluate various multi-level inverter configurations
- Compare various FACTS devices for VAR compensation
List of Experiments:

Lab experiments shall be based on the course content and few experiments shall involve the analyzing and designing skills besides the basic understanding of the subject. A list provided here is to indicate the type of experiments that can be included. About 10 experiments (from different topics) shall be included to cover the entire course.

1. Evaluate the performance and operating modes of SLR/PLR dc-dc converter with the change in switching frequency.
2. Simulate/Design a circuit for a Buck Converter with ZVS/ZCS to regulate the output voltage Vo with a given input voltage Vin.
3. Carrier based Sine PWM control of a CHB multilevel inverter and study of harmonic spectrum.
4. Study the operation and performance of second order converters like Buck-Boost, Flyback, Forward converters etc.
5. Study the operation and performance of fourth order converters like C’uk or Sepic converters
6. Evaluate the performance of STATCOM/SVC as a shunt compensator.
7. Study of harmonic spectrum for 12 and 18 pulse converters.

Design based Problems (DP)/Open Ended Problem:
Course coordinator can assign the design based problem/open ended problem.

Major Equipment:

Simulation software like MATLAB, PSIM, Scilab, Power Electronic Converters, CRO/DSO, meters, Current/Voltage Probes, Isolation transformer etc. as demanded by the course.

List of Open Source Software/learning website:

1. MIT OPEN COURSEWARE by Massachusetts Institute of Technology  
   - website: ocw.mit.edu
2. Courses available through NPTEL.  
   - website : nptel.ac.in

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.