

## PEL5I101 POWER ELECTRONICS

### Module-1 (12 Hours)

#### University portion (80%): (10 Hours)

#### 1. Power semiconductor devices: (6 Hours)

Switching and V-I characteristic of devices: power diode, Thyristor family: SCR, TRIAC, GTO, Transistor Family: BJT, IGBT, and MOSFET, Series and parallel grouping of SCR. [Chapter: 1.3, 1.4, 4.2.2, 4.2.3, 4.3.2, 4.6, 4.10, 7.2, 7.4, 7.5]

#### 2. Triggering Methods: (2 Hours)

SCR: (Cosine Firing Scheme), BJT gate drive, IGBT gate drive, TRIAC firing circuit, Isolation of gate and base drive [Chapter: 17.5, 17.2, 17.3, 17.4]

#### 3. Protection of Devices: (2 Hours)

SCR: Over voltage, Over Current,  $dv/dt$ ,  $di/dt$ , Gate Protection. Transistor: protection of power BJT, IGBT and power MOSFET,  $dv/dt$  &  $di/dt$  limitation. [Chapter: 18.4, 18.5, 18.7, 18.8, 4.8, 7.9, 7.10]

#### College/Institute portion (20%): (2 Hours)

Two-Transistor Model of SCR, V-I characteristics of RCT, MCT, [Chapter: 7.3, 7.6.6, 7.6.12, 7.7, 7.8] Or related advanced topics as decided by the concerned faculty teaching the subject.

### Module 2 (12 Hours)

#### University portion (80%): (10 Hours)

#### 1. AC to DC converter: (6 Hours)

Un-controlled Diode rectifier: Single phase half wave and full wave rectifiers with R-L and R-L-E load, 3 phase bridge rectifier with R-L and R-L-E load. Phase Controlled Converter: Principle of phase controlled converter operation, single phase full converter with R-L and R-L-E load, 3 phase full converter with R-L and R-L-E load, single phase semi converter with R-L and R-L-E load, 3 phase semi-converter with R-L and R-L-E load and effect of source inductance. [Chapter: 3.2, 3.3, 3.4, 3.5, 3.8, 3.12, 10.2, 10.3, 10.6, 10.9, 10.10]

#### 2. AC -AC converter: (4 Hours)

AC voltage controller: Single phase bi-directional controllers with R and R-L load, single phase cycloconverters. [Chapter: 11.4, 11.5, 11.9.1, 11.10]

#### College/Institute portion (20%): (2 Hours)

Effect of Source and Load Inductance, Single phase PWM rectifier, Three phase PWM rectifier. [Chapter: 6.6, 11.13] Or related advanced topics as decided by the concerned faculty teaching the subject.

### Module 3 (8 Hours)

#### University portion (80%): (6 Hours)

#### 1. DC to DC converter:

Classification: First quadrant, second quadrant, first and second quadrant, third and fourth quadrant, fourth quadrant converter. Switching mode regulators: Buck regulators, Boost regulators, Buck-Boost regulators, Cuk regulators, Isolated Types: Fly Back Converters, Forward converters, Push Pull Converters, Bridge Converter [Chapter: 5.7, 5.8.1, 5.8.2, 5.8.3, 5.8.4]

**College/Institute portion (20%): (2 Hours)**

Multioutput boost converter, Diode rectifier-fed Boost converter [Chapter: 5.10, 5.11] Or related advanced topics as decided by the concerned faculty teaching the subject.

**Module 4  
Hours)**

**(8**

**University portion (80%): (6 Hours)**

**1. DC to AC converter: (4 Hours)**

Inverters: Single phase Bridge Inverters, 3-Phase Inverters-180° mode conduction, 120° mode conduction. Voltage control of 3-Phase Inverters by Sinusoidal PWM, Current Source Inverter [Chapter: 6.4, 6.5, 6.8.1, 6.8.4, 6.10, 8.8, 8.9]

**2. Applications: (2 Hours)**

UPS, SMPS, Battery Chargers, SVC. [Chapter: 14.2.1, 14.2.2, 14.2.3, 14.2.4, 14.2.6, 13.6.4]

**College/Institute portion (20%): (2 Hours)**

Zero Current Switching, Zero voltage Switching technology in DC-DC converter, Zero Voltage Switching resonant inverter. [Chapter: 8.8, 8.9] Or related advanced topics as decided by the concerned faculty teaching the subject.

**Text Books:**

1. *Power Electronics: Circuits, Devices and Applications* by M H Rashid, 3<sup>rd</sup> Edition, Pearson
2. *Power Electronics: By P. C. Sen*, Tata McGraw Hill Education, 12<sup>th</sup> Edition

**Reference Books:**

1. *Power Electronics Converters, Applications & Design: by N. Mohan*, 2<sup>nd</sup> Edition, John Wiley & Sons
2. *Elements Of Power Electronics: Philip T. Krein*, Oxford University Press
3. *Power Converter Circuits: by W Shepherd and L Zhang*, CRC, Taylor and Francis, Special Indian Edition