

**M.E Semester: 2**  
**Electrical Engineering (Electrical Power System)**  
**Subject Name: Advanced Power Electronics**

**A. Course Objective:**

- To review basic concepts of power electronics in the field of power control and drives
- To address the underlying concepts and methods behind Advanced Power Electronics
- To impart knowledge of power semiconductor technologies and their advancement in the field of power conversion.

**B. Teaching / Examination Scheme**

SUBJECT		Teaching Scheme				Total Credit	Evaluation Scheme					Total Marks
		L	T	P	Total		THEORY		IE	CIA	PR. / VIVO	
CODE	NAME	Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	
MEEPS-203	Advanced Power Electronics	4	0	2	6	5	3	70	30	20	30	150

**C. Syllabus**

SR No.	Unit No	Topic	No. of Hours	Approx. Weightage in Exam.
1	<b>Unit:1</b>	<b>Introduction:</b> review of power semiconductor devices: Thyristor, IGBT, MOSFET, IGCT, GTO and their driver circuits, role of SiC in power semiconductor technology	6	10%
2	<b>Unit: 2</b>	<b>AC-DC converter:</b> Uncontrolled rectifier, semi-controlled rectifiers, fully controlled rectifiers with R, RL and RLE load, effect of source inductance on performance of converter, firing schemes and circuits, <b>MULTIPULSE CONVERTERS:</b> Multi-pulse converters: 12,18 and 24 pulse converters, phase shifting transformers <b>POWER FACTOR:</b> power factor improvement techniques, PWM rectifiers: equal area PWM, sine PWM, Single Phase and Three phase boost rectifier circuits	16	25%

3	<b>Unit: 3</b>	<b>DC-AC converters:</b> <b>Voltage Source Inverter:</b> 120° and 180° conduction modes, <b>PWM techniques of voltage fed converters:</b> Selective Harmonic Elimination (SHE), sine modulation, Third harmonic injection, Hysteresis Current Control, Sigma-Delta Modulation, Space Vector Pulse Width Modulation: undermodulation and overmodulation and their implementation <b>Current Source Inverter:</b> Current Source inverters and their role in high power drives: Autosequential Current Fed inverter, Pulse Width Modulation of CSI <b>Matrix converters:</b> Three phase matrix converters and their control, basic input filter, protection of matrix converter	20	30%
4	<b>Unit: 4</b>	<b>Multilevel inverters:</b> Diode Clamped MLI, Flying Capacitor MLI, Cascaded H-Bridge topology: operation with equal and unequal DC voltages, Carrier modulation schemes of multilevel inverter, SVPWM of Multilevel inverter, Neutral Point Balancing schemes	8	15%
5	<b>Unit: 5</b>	<b>Advance Electrical Drives:</b> <b>Brushless DC motor:</b> Sinusoidal and Trapezoidal BLDC motor, Electronic Commutator, Torque production in BLDC motor, Control of Brushless DC drives <b>Switched Reluctance Motor:</b> Elementary Operation and Principle of operation, Modes of operation, Converter circuits for SRM: Asymmetric Bridge Converter, R-Dump, Bifilar Type converter	10	20%

#### D. Instructional Methods

- At the start of course, the course delivery pattern , prerequisite of the subject will be discussed
- Lecture may be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory, which may carries five marks in overall evaluation.
- Two internal exams may be conducted and average of the same may be converted to equivalent of 15 marks as a part of internal theory evaluation.
- Assignment based on course content will be given to the student for each unit/topic and will be evaluated at regular interval. It may carry an importance of five marks in the overall internal evaluation.

- Surprise tests/Quizzes/Seminar/Tutorial may be conducted and having share of five marks in the overall internal evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concept being taught in lectures.
- Experiments shall be performed in the laboratory related to course contents.

#### **E. Students Learning Outcomes**

- The student can identify different areas power conversion and related topology.
- Can find the applications of power electronics in day to day life.

#### **F. Recommended Study Materials**

- **Text & Reference Books:**

1. Rashid, M. H., '*Power Electronics Circuits, Devices, and Applications*', Prentice-Hall of India Pvt. Ltd., New Delhi, 2nd edition, 1999
2. B.K. Bose, '*Modern Power Electronics and AC drives*', Prentice-Hall of India Pvt. Ltd., New Delhi
3. Dubey G.K., '*Power Semiconductor Controlled Drives*', Prentice-Hall, Eaglewood Cliffs, New Jersey, 2002
4. Ned Mohan, Tore M. Undeland and William P. Robbins, '*Power Electronics Converters, Applications, and Design*', John Willey & Sons, Inc., 2nd Edition, 1999
5. Sen P.C., '*Thyristor DC drives*' John wiley and sons, New York, 1981
6. Bin Wu, '*High power converters and ac drives*', Wiley-IEEE Press, 2002.