

# GUJARAT TECHNOLOGICAL UNIVERSITY

## POWER ELECTRONICS (29) ELECTROMAGNETIC COMPATIBILITY IN POWER ELECTRONICS SUBJECT CODE: 2742902 M.E. 4<sup>TH</sup> SEMESTER

**Type of course:** Major Elective-V

**Prerequisite:** Fundamental knowledge of Power Electronics Systems, and harmonics generated due to operation of Power Electronics converters.

**Rationale:** Power Electronics has grown as a major and extremely important discipline. This course provides the basic concept about the electromagnetic interference generated due to Power Electronics Systems and its applications in various engineering sectors.

### Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P		Theory Marks		Practical Marks				
			ESE (E)	PA (M)	ESE (V)		PA (I)			
					ESE	OEP	PA	RP		
3	2#	0	4	70	30	30	0	10	10	150

### Content:

Sr. No.	Content	Total Hrs.	% Weightage
1	<b>Introduction:</b> Introduction to EMI/EMC, EMC Standardization Efforts, Description of electromagnetic disturbances, Disturbances by Frequency Content, Disturbances by Character, Disturbances by Transmission mode, Compatibility between and within systems, Scope of EMC.	06	10
2	<b>EMI Measurement:</b> EMI Measuring Instruments, Test Equipments, Basic Terms and Conducted EMI References, Measuring the Interference Voltage, Measuring the Interference Current, Spectrum Analyzers, EMI Measurements for Consumer Appliances, Measuring Impulses-like EMI	06	10
3	<b>EMI in Power Electronic Equipments &amp; EMI Filter Elements:</b> EMI from Power Semiconductors, EMI from Power Converters Circuits, EMI Calculation for Equipments, Measuring HF Characteristics of EMI Filter Elements.	06	15
4	<b>Noise Suppression:</b> Noise Suppression in Relay Systems, Application of AC Switching Relays, Application of RC-Snubbers to Power Semiconductors, Shielded Transformers, Capacitor Filters, EMI Generation and Reduction at Its Source, Influence of Layout and Control of Parasitics.	04	10
5	<b>EMI Filter Circuit &amp; Design:</b> Selection and Measurement, Definition of EMI Filter Parameters, EMI Filter Circuits, Test Methods, EMI Filter Design, EMI Filter Design for	10	20

	Insertion Loss, Calculation of Worst-Case Insertion Loss, Design Method for Mismatched Impedance Condition, Design Method for EMI Filters with Common- Mode Choke Coils, Damped EMI Filters and Lossy Filter Elements.		
6	Testing for Susceptibility to Power Line Disturbances, Surge Voltages in AC Power Mains, EMC Tests per IEC Specifications, Other EMS Test Methods, and Reduction Techniques for Internal EMI, Conductive Noise Coupling, Electromagnetic Coupling, Electromagnetic Coupling Reduction Methods, Wiring Layout Methods to Reduce EMI Coupling PCB Design Considerations.	10	20
7	Transient Susceptibility Analysis Method, Noise Filter Design Method for Voltage Attenuation, Calculating the Energy Content of Transient Disturbances, Impulse Characteristics and Noise Filter Design, Surge Protection Devices.	06	15

### Reference Books:

- 1 L. Tihanyi, "Electromagnetic compatibility in Power Electronics, IEEE press
- 2 M. H. Rashid, "Power electronics Handbook", PHI
- 3 Bruce Archambeault, Colin Brench, Omar M. Ramahi, "EMI/EMC computational modeling handbook", Kluwer press
- 4 D. Morgan, "A Handbook for EMC Testing and Measurement"
- 5 Tim Williams, "EMC for product designers", Newnes press.

### Course Outcomes:

After learning the course the students should be able to:

1. Understand the fundamental concepts of EMI/EMC.
2. Understand Testing and measurement of EMI.
3. Understand EMI Filter circuits and its design.

### List of Open Source Software/learning website:

1. [www.nptl.ac.in](http://www.nptl.ac.in)
2. [www.cst.com/Applications/EMC\\_EMI](http://www.cst.com/Applications/EMC_EMI)

**Review Presentation (RP):** The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website.