

GUJARAT TECHNOLOGICAL UNIVERSITY

POWER ELECTRONICS AND ELECTRICAL DRIVES ELECTROMAGNETIC COMPATIBILITY IN POWER ELECTRONICS

SUBJECT CODE: 2744502

M.E. 4TH SEMESTER

Type of course: Engineering Science (Electrical)

Prerequisite: NA

Rationale: NA

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	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	Introduction: History of EMC Standardization Efforts, Description of electromagnetic disturbances, Classifying Disturbances by Frequency Content, Classifying Disturbances by Character, Classifying Disturbances by Transmission mode.	3	10
2	EMI Measurement: EMI Measuring Instruments, Basic Terms and Conducted EMI References, Measuring the Interference Voltage, Measuring the Interference Current, Spectrum Analyzers, EMI Measurements for Consumer Appliances, Measuring Impulse-Like EMI.	6	20
3	EMI in Power Electronic Equipment: EMI from Power Semiconductors, EMI from Controlled Rectifier Circuits, EMI Calculation for Semiconductor Equipment, EMI Filter Elements, Measuring HF Characteristics of EMI Filter Elements	7	15
4	Noise Suppression: 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.	8	20
5	EMI Filter Circuit: Selection and Measurement, Definition of EMI Filter Parameters, EMI Filter Circuits, Insertion Loss Test Methods, EMI Filter Design, EMI Filter Design for 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, HF Characteristics of Noise Filter Circuit Elements	8	20
6	EMC Tests:	4	5

	Testing for Susceptibility to Power Line Disturbances, Surge Voltages in AC Power Mains, EMC Tests per IEC Specifications, Other EMS Test Methods, Reduction Techniques for Internal EMI, Conductive Noise Coupling, Electromagnetic Coupling		
7	Case Study: EMC study of an insulated DC-DC fly back power supply, conducted perturbations of a step-up chopper, The effect of zero voltage switching on EMC in a power factor corrector, EMI Study of Three-Phase Inverter-Fed Motor Drives	6	10

Reference Books:

1. L. Tihanyi, "Electromagnetic Compatibility in Power Electronics", IEEE press, 1995.
2. M. H. Rashid, "Power electronics Handbook", Butterworth-Heinemann, 3rd edition, 2010.
3. F. Mazda, "Power electronics Handbook", 3rd edition, Newnes, 1997.
4. Bruce Archambeault, Colin Brench, Omar M. Ramahi, "EMI/EMC computational modeling handbook", Kluwer academic publishers, 1998.
5. D. Morgan, "A Handbook for EMC Testing and Measurement", Institution of Engineering and Technology, 1994.
6. Tim Williams, "EMC for product designers", 4th edition, Newnes, 2007.
7. François Costa, Cyrille Gautier, Eric Labouré, Bertrand Revol, "Electromagnetic Compatibility in Power Electronics", Wiley-ISTE, 2014.

Course Outcome:

After learning the course the students should be able to:

1. Understand different sources of interference.
2. Understand the concept of EMI measurement and measuring instrument.
3. Calculate EMI in power electronic equipment.
4. Understand the filter circuits.
5. Understand noise suppression.
6. Design the EMI filter.
7. Understand and reduce EMI in power electronic circuits like DC-DC converter and inverter.

Major Equipment:

Necessary instruments, kits and apparatus are to be provided for conducting above said practical in a group of maximum four students.

List of Open Source Software/learning website:

1. E-materials available at the website of NPTEL- <http://nptel.ac.in/>
2. Pspice (Trial version): Software is useful for simulation and analysis of electrical systems
3. MATLAB (Trial version): Software is useful for simulation and analysis of electrical systems

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.