

M.E Semester: 2**Electrical Engineering (Electrical Power System)****Subject Name: Harmonic Measurement and Filtration Techniques (Major Elective-II)****A. Course Objective:**

- To introduce students to measurement of harmonics in the power system
- To enable students to learn harmonic filtration techniques
- To impart knowledge of converter topologies and their control strategies in the field of active power filters.

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	Marks	
MEEPS-204B	Harmonic Measurement and Filtration Techniques	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	Unit:1	The instantaneous Power Theory: Basics of p-q Theory, p-q theory in Three phase-Three wire systems, p-q theory in Three phase, Four-wire systems, Instantaneous abc Theory, comparison between pq and abc Theory.	8	10%
2	Unit: 2	Harmonic Filtering Techniques: Passive filter design, single tuned filter, Band pass filter, Tuned harmonic filter design, other methods to decrease harmonic distortion Limits	12	15%

3	Unit: 3	Active Filters: General description of Shunt Active filters, 3-phase, 3-wire shunt active filters, Active filters for current minimization, Active filters for harmonic damping, 3-phase, 4-wire shunt active filters, Hybrid and series active filters, comparison with pure active filters, Hybrid and series filters Combined series and shunt power conditioners, Unified Power Flow Controller (UPFC), Unified Power Quality Controller (UPQC)- basic concepts.	32	60%
4	Unit: 4	Harmonic Analysis: Harmonic source representation, Harmonic Propagation facts, flux of harmonic currents, Interrelation between AC system and Load Parameters Analysis methods	8	15%

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

- Students will be able to measure and mitigate harmonics in the power system.

- Students will be able to understand various power filter topologies for harmonic mitigation.

F. Recommended Study Materials

• **Text &Reference Books:**

1. Harmonics and Power systems By Francisco C. De La Rosa Taylor& Francis group, CRC Press
2. *Power System Harmonics, Second Edition* J. Arrillaga, N.R. Watson, John Wiley & Sons, Ltd ISBN: 0-470-85129-5
3. Power Electronics Converter Harmonics By Deare A Paice, IEEE Press
4. Instantaneous Power Theory and Application to Power Conditioning By Hirofumi Akagi et al., IEEE Press, Willey-Interscience A Jhon Willey & Son Publication,

