

POWER QUALITY & FACTS

Course Code	19EE4702B	Year	IV	Semester	I
Course Category	Program Elective-V	Branch	EEE	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	Power Electronics, Power Systems
Continuous Internal Evaluation	30	Semester End Evaluation	70	Total Marks	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Observe various Power Quality problems related to voltage and frequency. (L1)
CO2	Identify various sources of voltage disturbances and suggest suitable mitigating techniques.
CO3	Observe the concepts of various FACTS controllers.(L1)
CO4	Estimate the effect of shunt and series reactive compensation
CO5	Illustrate the impact of FACTS controllers on power systems.(L2)

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:High, 2: Medium, 1:Low)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2												2	2
CO2	2	2											2	2
CO3	2												2	2
CO4	2	2											2	2
CO5	2	2											2	2

SYLLABUS		
Unit No.	Contents	Mapped CO
I	Power and Voltage Quality General classes of power quality problems, Power quality terms, Power frequency variations, power quality evaluation procedure. Voltage quality Transients, long and short duration voltage variations, Voltage imbalance, Waveform distortion, Voltage flicker. Voltage sags and Interruptions Sources of sags and interruptions, Estimating Voltage sag performance.	CO1, CO2
II	Fundamental Principles of Protection Solutions at the end-user level, Evaluating economics of different ride-through alternatives, Motor-Starting Sags	CO2
III	FACTS Concept and general system considerations Flow of power in an AC system. Limits of the loading capability. Power flow and dynamic stability considerations of a transmission interconnection.	CO3, CO5

	Relative importance of controllable parameters, types of FACTS controllers, basic concepts of Active filter, UPFC, IPFC and DSTATCOM	
IV	Static shunt compensators Objectives of shunt compensation, midpoint voltage regulation for line segmentation, end of line voltage support to prevent voltage instability, methods of controllable var generation, variable impedance type static var generators – TCR and TSR, TSC, FC-TCR, TSC-TCR	CO4 CO5
V	Static series compensators Concept of series capacitive compensation, improvement of transient stability, power oscillation damping. GTO thyristor controlled series capacitor (GSC), thyristor switched series capacitor (TSSC), and thyristor controlled series capacitor (TCSC)	CO4 CO5

Learning Resources

Text Books:

1. Electrical Power Systems Quality by Roger C. Dugan, Mark F. Mc Granaghan, Surya Santoso, H. Wayne Beaty, Third edition, TMH publishers, 2012
2. Understanding FACTS, N.G. Hingorani and L. Gyugi, Delhi IEEE Press 2001

Reference Books:

1. Understanding Power Quality Problems by Math H.J. Bollen, Wiley-IEEE press, 1999
2. Flexible AC transmission system (FACTS) by YONG HUE SONG and ALLAN T JOHNS, Institution of Electrical Engineers, London

Learning Resources:

<https://nptel.ac.in/courses/108/106/108106025/>

<https://nptel.ac.in/courses/108/107/108107114/>