SARDAR RAJA COLLEGE OF ENGINEERING, ALANGULAM

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

MICRO LESSON PLAN

SUBJECT : POWER QUALITY

CODE : EE 801

CLASS : IV Year / VIII SEM

STAFF: Ms. M.RATHIKA,
A.P/EEE

EE801 POWER QUALITY **L T P C**
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UNIT I INTRODUCTION TO POWER QUALITY 9

Terms and definitions: Overloading - under voltage - over voltage. Concepts of transients - short duration variations such as interruption - long duration variation such as sustained interruption. Sags and swells - voltage sag - voltage swell -voltage imbalance - voltage fluctuation - power frequency variations. International standards of power quality. Computer Business Equipment Manufacturers Associations (CBEMA) curve.

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UNIT II VOLTAGE SAGS AND INTERRUPTIONS 9

Sources of sags and interruptions - estimating voltage sag performance. Thevenin's equivalent source - analysis and calculation of various faulted condition. Voltage sag due to induction motor starting. Estimation of the sag severity - mitigation of voltage sags, active series compensators. Static transfer switches and fast transfer switches.

UNIT III OVERVOLTAGES 9

Sources of over voltages - Capacitor switching – lightning - ferro resonance. Mitigation of voltage swells - surge arresters - low pass filters - power conditioners. Lightning protection – shielding - line arresters - protection of transformers and cables. An introduction to computer analysis tools for transients, PSCAD and EMTP.

UNIT IV HARMONICS 9

Harmonic sources from commercial and industrial loads, locating harmonic sources. Power system response characteristics - Harmonics Vs transients. Effect of harmonics - harmonic distortion - voltage and current distortion - harmonic indices -inter harmonics – resonance. Harmonic distortion evaluation - devices for controlling harmonic distortion - passive and active filters.IEEE and IEC standards.

UNIT V POWER QUALITY MONITORING 9

Monitoring considerations - monitoring and diagnostic techniques for various power quality problems - modeling of power quality (harmonics and voltage sag) problems by mathematical simulation tools - power line disturbance analyze quality measurement equipment - harmonic / spectrum analyzer - flicker meters -disturbance analyzer. Applications of expert systems for power quality monitoring.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Roger. C. Dugan, Mark. F. McGranagham, Surya Santoso, H.Wayne Beaty, 'Electrical Power Systems Quality' McGraw Hill,2003.(For Chapters1,2,3, 4 and 5)

REFERENCES

1. G.T. Heydt, 'Electric Power Quality', 2nd Edition. (West Lafayette, IN, Stars in a Circle Publications, 1994). (For Chapter 1, 2, 3 and 5)
2. M.H.J Bollen, 'Understanding Power Quality Problems: Voltage Sags and Interruptions', (New York: IEEE Press, 1999). (For Chapters 1, 2, 3 and 5)
3. J. Arrillaga, N.R. Watson, S. Chen, 'Power System Quality Assessment', (New York: Wiley, 1999). (For Chapters 1, 2, 3, 4 and 5)
4. PSCAD User Manual.

SUBJECT DESCRIPTION AND OBJECTIVES

DESCRIPTION

To study the various issues affecting power quality, their production, monitoring and suppression. Power quality determines the fitness of electrical power to consumer devices. The set of limits of electrical properties allows electrical systems to function in their intended manner without significant loss of performance or life. The term is used to describe electric power that drives an electrical load and the load's ability to function properly. Without the proper power, an electrical device (or load) may malfunction, fail prematurely or not operate at all. There are many ways in which electric power can be of poor quality and many more causes of such poor quality power. Power quality is a tool to determine the perfect flow of power systems with sufficient number of losses. This system analyzes the problems in power system and provides a significant technique to avoid distortion in lines. It is a magnificent tool to disrupt the malfunction to avoid a permanent failure in power systems.

OBJECTIVE:

- To study the production of voltages sags, over voltages and harmonics and methods of control.
- To study various methods of power quality monitoring.
- To study the various issues affecting power quality, their production, monitoring and suppression.

MICRO LESSON PLAN

Hours	LECTURE TOPICS	READING
UNIT I INTRODUCTION TO POWER QUALITY		
1	Terms and definitions: Overloading - under voltage – over voltage	T1
2	Concepts of transients	T1
3	Short duration variations such as interruption	T1
4	Long duration variation such as sustained interruption	T1
5	Sags and swells - voltage sag - voltage swell	T1
6	Voltage imbalance - voltage fluctuation	T1
7	Power frequency variations	T1
8	International standards of power quality	T1
9	Computer Business Equipment Manufacturers Associations (CBEMA) curve.	T1

UNIT II VOLTAGE SAGS AND INTERRUPTIONS		
10	Sources of sags	T1
11	Sources of interruptions	T1
12	Estimating voltage sag performance	T1
13	Thevenin's equivalent source	T1
14	Analysis and calculation of various faulted condition	T1
15	Voltage sag due to induction motor starting	T1
16	Estimation of the sag severity	T1
17	Mitigation of voltage sags, active series compensators	T1
18	Static transfer switches and fast transfer switches	T1
UNIT III OVERVOLTAGES		
19	Sources of over voltages	T1
20	Capacitor switching – lightning - ferro resonance	T1
21	Mitigation of voltage swells	T1
22	Surge arresters	T1
23	Low pass filters - power conditioners	T1
24	Lightning protection – shielding - line arresters	T1
25	Protection of transformers and cables	T1
26	An introduction to computer analysis tools for transients	T1
27	PSCAD and EMTP	T1
UNIT IV HARMONICS		
28	Harmonic sources from commercial and industrial loads, locating harmonic sources	T1

29	Power system response characteristics	T1
30	Harmonics Vs transients. Effect of harmonics	T1
31	Harmonic distortion	T1
32	Voltage and current distortion	T1
33	Harmonic indices - inter harmonics – resonance	T1
34	Harmonic distortion evaluation	T1
35	Devices for controlling harmonic distortion - passive and active filters	T1
36	IEEE and IEC standards	T1
UNIT V POWER QUALITY MONITORING		
37	Monitoring considerations	T1
38	Monitoring and diagnostic techniques for various power quality problems	T1
39	Modeling of power quality (harmonics and voltage sag)	T1
40	Problems by mathematical simulation tools	T1
41	Power line disturbance analyzer	T1
42	Quality measurement equipment	T1
43	Harmonic / spectrum analyzer	T1
44	Flicker meters - disturbance analyzer	T1
45	Applications of expert systems for power quality monitoring	T1

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