

QUESTION BANK

SUBJECT: EE6005-Power Quality

SEM / YEAR: VII SEMESTER / ACADEMIC YEAR 2018-2019

UNIT I - INTRODUCTION TO POWER QUALITY			
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.			
PART - A			
Q.No	Questions	BT Level	Competence
1.	Define voltage swell	1	Remember
2.	List the major power quality issue	1	Remember
3.	Define voltage sag	1	Remember
4.	Define the power quality as per IEEE	1	Remember
5.	What are the main components of power quality	1	Remember
6.	Define momentary interruption and components of waveform distortion	1	Remember
7.	Comment” harmonics affect the electrical system”	2	Understand
8.	Differentiate inter harmonic and sub harmonics	2	Understand
9.	Illustrate about notching in power quality	2	Understand
10.	Differentiate between voltage sag and voltage swell	2	Understand
11.	Classify the types of power quality solutions available on the market today	3	Apply
12.	How are the power quality problems detected?	2	Understand
13.	Find the harmonic distortion of a voltage waveform with following harmonic frequency make up: fundamental=114V, 3 rd harmonic=4V, 5 th harmonic=27V, 7 th harmonic=1.5V and 9 th harmonic=1V	3	Apply

14.	List out the need of power quality standards	4	Analyze
15.	Comment transients or noise on the power line causing problems now	4	Analyze
16.	What are the reasons voltage imbalance	4	Analyze
17.	Criticize “capacitor switching leads to overvoltage”	5	Evaluate
18.	Distinguish sag and swell	5	Evaluate
19.	What do you mean by power frequency variations in power quality	6	Create
20.	Plot the CBEMA curve	6	Create
PART – B			
1.	(i)Name and explain different types of power quality issues that affects the power systems depending upon the severity? (6)	1	Remember
	(ii)Define Total Harmonic Distortion. Explain the procedure for calculation the Total Harmonic Distortion(THD) due to disturbance in the power system (7)	1	Remember
2.	(i) Discuss the following characteristics of power quality issue (7)	1	Remember
	(a) Short duration variations		
	(b) Long duration variations	1	Remember
	(ii)Discuss in detail about transients (6)		
3.	(i) Describe the CBEMA and ITI curve (7)	1	Remember
	(ii)Define waveform distortion and explain the waveform distortion categories (6)	1	Remember
4.	Write short notes on following power quality issues (13)		
	(i) Harmonics	1	Remember
	(ii) Power frequency variations		
5.	Discuss the source and effects of different categories of long duration voltage variations that affect the power quality (13)	2	Understand
6.	Explain power quality and explain the reasons for increased concern in power quality (13)	2	Understand

7.	Discuss the following electrical power quality issue with examples (13) (a) Voltage swell (b) Voltage interruption	2	Understand
8.	Explain the various types of power quality disturbances in power system and also explain the characteristics of each disturbance (13)	3	Apply
9.	(i) Summarize the impact of poor power quality on utility and consumers (7) (ii) Discriminate on over voltage and under voltage in power quality issue (6)	3 3	Apply Apply
10.	Formulate different categories and characteristics of power quality disturbance in power system network and point out which disturbance have most affect the power quality (13)	4	Analyze
11.	(i) Explain total harmonic distortion and total demand distortion (7) (ii) Discuss the standards of power quality (6)	4 4	Analyze Analyze
12.	(i) Demonstrate the major reasons for the growing concern about the quality of electric power by both electric utilities and end users (7) (ii) Illustrate the principle phenomenon causing electric magnetic disturbance classified by International Electro technical commission (6)	6 6	Create Create
13.	With a waveform sketch, explain the terms (13) (a) Voltage sag (b) Voltage interruption (c) Voltage swells (d) Sag with harmonics	5	Evaluate

14.	(i)Discuss about the Computer Business Equipment Manufactures Associations(CBEMA) curve.Explain the events described in the curve. (7)	2	Understand
	ii)Differentiate between power quality, voltage quality and current quality (6)	2	Understand
PART – C			
1	Explain the following electrical power quality issues in detail with examples i) Voltage Imbalance ii) Transient (15)	4	Analyze
2	Discuss in detail about transients and waveform distortion related to the power quality (15)	5	Evaluate
3	Explain briefly about international standard of power quality (15)	4	Analyze
4	Explain the various types of power quality disturbances (15)	5	Evaluate

UNIT II - VOLTAGE SAGS AND INTERRUPTIONS

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.

PART – A

Q.No	Questions	BT Level	Competence
1.	When sag leads to interruption	1	Remember
2.	List out the causes of sag	1	Remember
3.	List out the three levels of possible solutions to voltage sag and momentary interruption problems	1	Remember
4.	List some industry standards associated with voltage sags	1	Remember
5.	Name the sources of sags and interruption	1	Remember
6.	Interpret the various factors affecting the sag magnitude due to faults at a certain point in the	2	Understand
7.	What are the causes of short interruption	2	Understand
8.	Classify different types of voltage sag	3	Apply
9.	Name the different motor starting methods.	2	Understand
10.	Differentiate voltage swell and voltage transients	2	Understand
11.	How to estimate voltage sag performance	1	Remember
12.	Describe the importance of voltage sag estimation	2	Understand
13.	Demonstrate how voltage sag can be mitigated and list the types to mitigation devices	3	Apply
14.	Demonstrate the causes for voltage sags due to transformer energizing	3	Apply
15.	Define active series compensator	4	Analyze
16.	Explain static transfer switch	5	Evaluate
17.	Design the active low pass filter to mitigate the voltage swell	6	Create
18.	Summarize the main function of DSTATCOM	5	Evaluate
19.	What are the main functions of DVR?	4	Analyze
20.	Compose the active series compensator in voltage sag	6	Create
PART – B			
1.	(i) Explain the sources of sags in power system (7)	1	Remember
	(ii) Discuss the sources of interruption to affect the power quality (6)	1	Remember

2.	(i) Describe in detail about the sag performance evaluation indices. (7) (ii) Describe the methodology of estimating voltage sag performance (6)	1 1	Remember Remember
3.	Explain the following causes of sag (13) a) Voltage sag to motor b) Voltage sag due to single line to line fault c) Voltage sag due to single line to ground fault	3	Apply
4.	(i) Explain various indexes used to estimate voltage sag (7) (ii) Discuss some of the solutions for voltage sag and interruption (6)	2 2	Understand Understand
5.	What is the need for estimating sag performance Explain the different methods of estimating voltage sag Performance (13)	2	Understand
6.	Analysis and calculation of power quality due various faulted condition (13)	2	Understand
7.	(i) Explain performance voltage sag due to starting of large induction motor in distribution level (7) (ii) How does the load influence on voltage sag adjustable speed drives? (6)	4 6	Analyze Create
8.	Explain the operation of Distribution Static Compensator (DSTATCOM) used for sag mitigation (13)	4	Analyze
9.	Analyse the different methods for estimating voltage sag severity due to the disturbance in the power system (13)	5	Evaluate
10.	(i) Explain active series compensator to compensate the voltage sag occurs in power system (7) (ii) Explain how ferro resonance transformer to improve the voltage sag performance (6)	3 3	Apply Apply
11.	(i) Explain the solid state transfer switch with transfer operation (7) (ii) Explain fast transfer switch with transfer operation (6)	3 3	Apply Apply

12.	(i) What are the different voltage sag mitigation techniques? Explain the principle of operation of DVR used for sag mitigation (7)	6	Create
	(ii) Analyze about estimating the cost of voltage sag events in the power system (6)	1	Remember
13.	Explain any two voltage sag mitigation Techniques with necessary circuit diagram and waveform (13)	4	Analyze
14.	Explain the role of compensators in mitigation of voltage sags. (13)	5	Evaluate
PART – C			
1	Describe the procedure for estimating motor switching voltage sag (15)	5	Evaluate
2	Discuss the effects of voltage sag and interruption on various electrical equipment (15)	4	Analyze
3	What are the different voltage sag mitigation sag techniques? Explain in detail (15)	5	Evaluate
4	Briefly explain static transfer switches and fast transfer switches (15)	4	Analyze

UNIT III - OVERVOLTAGES

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.

PART – A

Q.No	Questions	BT Level	Competence
1.	What is transient overvoltage?	1	Remember
2.	Define Ferro resonance	1	Remember
3.	Define lightning phenomena	1	Remember
4.	What is the significance of EMTP studies	2	Understand
5.	Write the need for power conditioners	2	Understand
6.	List the sources of over voltage	1	Remember
7.	Demonstrate the working principle of surge arrestor?	3	Apply
8.	When does Ferro resonance occur in a power system?	1	Remember
9.	Summarize the devices used for protection of over voltages?	2	Understand
10.	Show the causes for oscillatory voltage transients?	3	Apply
11.	Define impulsive transients and predict suitable examples	2	Understand
12.	Analyze the protection methods of cable against over voltages	4	Analyze
13.	Show the various causes of over voltages?	3	Apply
14.	Define voltage magnification.	1	Remember
15.	Prepare the common ways for the utility to protect the transformer	6	Create
16.	Analyze how does lightning cause over voltages?	4	Analyze
17.	Predict the functions of line arrestors	5	Evaluate
18.	Compare the difference between Transient Voltage Surge Suppressors (TVSS) and surge arrestors.	5	Evaluate
19.	What do you mean by capacitor switching	4	Analyze
20.	Why low-pass filter used in transient protection	6	Create
PART - B			
1.	Analyze the source of transient over voltages in power systems.	4	Analyze

2.	Write short notes on the following:			Understand
	(i) Low pass filters (7)	2		
	(ii) Power conditioner (6)	2		Understand
3.	(i) Explain the problems associated with Ferro resonance. (7)	4		Analyze
	(ii) What are the different sources of transient over voltages? Discuss the capacitor switching transient. (6)	1		Remember
4.	(i) Explain the underground cable system protection. (7)	4		Analyze
	(ii) Explain in detail about the protection of transformer (6)	4		Analyze
5.	Write short notes on the following	2		Understand
	(i) Lightning arrester (7)			
	(ii) Line arrester (6)	2		Understand
6.	Illustrate the phenomena of impulsive transients and oscillatory transients (13)	3		Apply
7.	Discuss the source of overvoltage due to following phenomena.			
	(i) Capacitor switching. (7)	2		Understand
	(ii) Magnification of Capacitor switching transients (6)	2		Understand
8.	List the fundamental principles of overvoltage protection of load equipment. (13)	1		Remember
9.	(i) Explain in detail about the surge arrestors and surge suppressors for over voltage protection. (7)	4		Analyze
	(ii) What are the advantages of surge arrestors? Discuss about the application module (6)	1		Remember
10.	(i) What are the various lightning protection schemes used for over voltage lines? (7)	6		Create
	(ii) Evaluate the use of PSCAD in analyzing the power quality. Integrate them. (6)	5		Evaluate
11.	Describe the sources of transient over voltages in high, medium and low frequency range. (13)	1		Remember
12.	Describe different methods of protection of transformers and cables against voltage transients. (13)	1		Remember

13.	(i) Describe the following mitigation technique of over voltages with diagrams	3	Apply
	(a) Shielding		
	(b) Cable Protection (10)	5	Evaluate
	(ii) Explain the “Ferro Resonance” in detail. (3)		
14.	(i) Define lightning. Discuss in detail about the over voltages due to lightning and the problems associated with it. (7)	3	Apply
	(ii) What are the advantages of computer analysis tools? Generalize about PSCAD and EMTP for transient studies? (6)	6	Create
PART-C			
1	What are the various lightning protection scheme used for over voltage protection under the presence of harmonics (15)	4	Analyze
2	Briefly explain about shielding and surge arrestor (15)	5	Evaluate
3	Explain in detail over voltages produced due to Ferro resonance (15)	4	Analyze
4	Explain in detail about various methods to mitigate voltage swells (15)	5	Evaluate

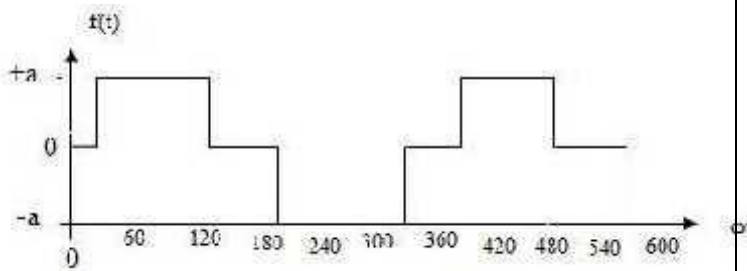
UNIT IV- HARMONICS

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.

PART - A

Q.No	Questions	BT Level	Competence
1.	State the different between harmonics and transients	3	Apply
2.	Define point of common coupling (PCC).	1	Remember
3.	Mention the harmonic effects on devices and loads.	2	Understand
4.	Analyze the objectives of IEEE and IEC standards?	5	
5.	Why even harmonics are normally absent in the power converters?	3	Apply
6.	Define harmonics.	1	Remember
7.	Interpret about Total Demand Distortion (TDD)?	2	Understand
8.	What are the various effects on devices and loads	3	Apply
9.	Define Total harmonic distortion	1	Remember
10.	Summarize the advantage of three phase converter	5	Evaluate
11.	Write the need of locating harmonic sources	1	Remember
12.	Point out the sources of harmonics from industrial loads	4	Analyze
13.	Distinguish between active filter and passive filter.	2	Understand
14.	Differentiate between linear loads and nonlinear loads	2	Understand
15.	Compose the difference between harmonics and inter harmonics	6	Create
16.	Infer voltage and current distortion?	4	Analyze
17.	What are the applications of active filters?	4	Analyze
18.	What is the significance of power quality indices	1	Remember
19.	Prepare the IEEE harmonic standard on harmonic distortion	6	Create
20.	Name the devices for controlling harmonic distortion	1	Remember

PART - B			
1.	Explain the methods to evaluate harmonic distortion and devices to control (13)	4	Analyze
2.	(i) Explain the IEEE and IEC standards on harmonics distortion. (7) (ii) What are the filters in harmonic analysis? Explain active and passive filters (6)	3 3	Apply Apply
3.	(i) Explain briefly how the phenomena of current distortion affects the voltage distortion under the presence of harmonics (7) (ii) Explain briefly about locating harmonic sources and characterization in power system (6)	4 4	Analyze Analyze
4.	(i) Explain the power system response characteristics under the presence of harmonics. (7) (ii) What is the need of IEEE standards used in harmonics studies? Give their philosophy and objectives of these standards (6)	4 1	Analyze Remember
5.	(i) Explain the fundamentals of harmonics generation and waveform distortion. (7) (ii) Prepare the following terms (a) Current distortion (b) Voltage distortion (6)	4 4	Analyze Analyze
6.	Discuss the effects of harmonics on electrical power components (13)	2	Understand
7.	Write short note on the active filter and passive filter in controlling harmonic distortion (13)	1	Remember
8.	Explain how commercial and industrial loads are responsible for harmonic distortion. (13)	5	Evaluate

9.	Determine the RMS and THD of the following waveform (13) 	3	Apply
10.	Discuss the characteristics of harmonics generated by different types of industrial load and commercial load(13)	1	Remember
11.	(i) Explain the waveform distortion due to different types of nonlinear loads (7) (ii) Write short notes on the following (i) Harmonic indices (ii) Inter harmonics (6)	4 2	Analyze Understand
12.	(i) Write short notes on THD and TDD. (3) (ii) Discuss the effects of harmonic distortion on transformers and motors. (10)	2 2	Understand Understand
13.	(i) What is meant by point of common coupling? Generalize the IEEE 519 standard and IEC 61000-3-2 standard with respect to harmonics. (7) (ii) Design the detail operation of shunt active filter. (6)	1 6	Remember Create
14.	(i) Demonstrate about evaluation of harmonic distortion (7) (ii) Define the following terms related with IEEE standards . (6) a) SCR b) Total harmonic distortion.	3 1	Apply Remember
PART-C			
1.	What are the devices used for controlling harmonic distortion and explain their function (15)	5	Evaluate
2.	Explain briefly about harmonic distortion and conduct an evaluation of study (15)	4	Analyze

3.	Explain briefly about the phenomena of how current distortion affects the voltage distortion under the presence of harmonics (15)	6	Create
4.	Explain the function of active filters and how it overcomes the drawbacks of passive filter in controlling harmonic (15)	5	Evaluate

UNIT V - POWER QUALITY MONITORING

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

PART - A

Q.No	Questions	BT Level	Competence
1.	What is the role of expert system in power quality studies	1	Remember
2.	Define power quality monitoring	1	Remember
3.	Interpret the merits of modelling and simulation?	2	Understand
4.	Prepare the online power quality monitoring merits?	6	Create
5.	What is flicker meter?	1	Remember
6.	Describe about signal processing tools for analyzing power quality issues	2	Understand
7.	Interpret the benefits of power quality monitoring?	2	Understand
8.	List some of the major power quality monitoring equipment.	1	Remember
9.	State and analyze the objectives of power quality monitoring	3	Apply
10.	List out the various power quality monitoring steps	5	Evaluate
11.	Analyze the merits of digital power quality analyzers?	4	Analyze
12.	Conclude the steps involved in power quality monitoring?	5	Evaluate
13.	Mention any two signal processing tools for analyzing power quality issues	3	Apply
14.	Estimate the importance of power quality monitoring?	2	Understand
15.	What is spectrum analyzer?	4	Analyze
16.	Name the factors of selecting the instrument for power quality monitoring	1	Remember
17.	Infer the power quality disturbance analyzer.	4	Analyze
18.	List the difference between offline and online power quality data assessment	1	Remember
19.	What is meant by proactive monitoring	1	Remember
20.	Write any two IEEE standards to assess the power quality monitoring	6	Create

PART - B			
1.	Discuss the power quality monitoring considerations in details. (13)	2	Understand
2.	Explain the flicker meter and flicker measurement techniques in details. (13)	3	Apply
3.	Explain in detail with necessary diagram the working principle and functioning of power quality analyzers(13)	5	Evaluate
4.	Briefly discuss the common objectives of power quality monitoring. (13)	2	Understand
5.	(i) Bring out the important characteristics of power quality variations. (7) (ii) Explain the steps involved in power quality monitoring. What are the information from monitoring site surveys? (6)	2	Understand
		1	Remember
6.	(i) Explain the various instruments used for power quality measurements. (7) (ii) What are the factors to be considered when selecting the instruments? (6)	1	Remember
		1	Remember
7.	Illustrate the importance of power line analyzer. (13)	3	Apply
8.	Explain the features of spectrum analyzer and flicker meters (13)	4	Analyze
9.	Describe the modelling of power quality problems by mathematical solution tools. (13)	1	Remember
10.	Write short note on the following (i) Disturbance analyzer (ii) Flicker meter (13)	2	Understand
11.	(i) Analyze the role and application of expert systems in power quality monitoring (7) (ii) Discuss briefly about the different features of harmonic analyzer (6)	4	Analyze
		2	Understand
12.	(i) Explain in detail about the flicker meter (7) (ii) Design and explain about power quality disturbance analyzer (6)	4	Analyze
		4	Analyze
13.	Design the block diagram of advanced power quality monitoring systems. Explain it in detail. (13)	6	Create

14.	.(i) Bring the significance of power quality maintaining? Demonstrate the objectives of power quality maintaining? (7)	3	Apply
	(ii) Write short notes on power quality measurement system. What are the characteristics of power quality measurement equipments? (6)	1	Remember
PART-C			
1	Explain monitoring requirement of different types of power quality variation (15)	4	Analyze
2	Discuss in detail about expert system for power quality monitoring (15)	5	Evaluate
3	Explain the steps involved in power quality monitoring. What are the information from monitoring site surveys (15)	5	Evaluate
4	Illustrate the features of power quality monitoring and assessment (15)	4	Analyze