	National Institute of Technology Meghalaya An Institute of National Importance	**CURRICULUM**

Programme	**Bachelor of Technology in Electrical and Electronics Engineering**	Year of Regulation	**2018-19**
Department	**Electrical Engineering**	Semester	**VIII**

Course Code	Course Name		Credit Structure				Marks Distribution			
			L	T	P	C	INT	MID	END	Total
EE412	**Power Quality**		**3**	**0**	**0**	**3**	**50**	**50**	**100**	**200**

Course Objectives	Course Outcomes		
To deliver fundamental concept on power quality, its classifications and related problems.		CO1	Able to demonstrate knowledge and understanding of concepts and basic principles of power quality.
To gather knowledge on power assessment techniques and power quality standards.		CO2	Able to evaluate the severity of sag, swell, harmonics, and transients in single and three-phase distribution networks.
		CO3	Able to understand power quality monitoring, assessment and classification techniques.
To discuss the waveform processing techniques and harmonics in power system.		CO4	Able to illustrate and describe solutions for different power quality problems and waveform processing technique.
		CO5	Able to analyze effects of harmonics and power system harmonic distortion.
To familiarize the concept of grounding and electrical wiring.		CO6	Able to acquire knowledge on different types of filters and harmonic control techniques
		CO7	Able to integrate knowledge and understanding of design and planning of electrical systems.

No.	COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CO1	**3**	**3**	**2**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**2**	**0**	**3**
2	CO2	**3**	**3**	**1**	**1**	**2**	**2**	**1**	**0**	**0**	**0**	**0**	**1**	**3**	**1**	**3**
3	CO3	**3**	**3**	**1**	**1**	**2**	**2**	**1**	**0**	**0**	**0**	**0**	**1**	**3**	**1**	**3**
4	CO4	**3**	**3**	**0**	**2**	**1**	**3**	**1**	**0**	**0**	**0**	**0**	**1**	**3**	**1**	**3**
5	CO5	**3**	**3**	**0**	**1**	**2**	**2**	**1**	**1**	**0**	**0**	**0**	**1**	**3**	**1**	**3**
6	CO6	**3**	**3**	**0**	**1**	**2**	**2**	**1**	**1**	**1**	**0**	**0**	**1**	**3**	**1**	**3**
7	CO7	**3**	**3**	**2**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**1**	**2**	**0**	**3**

SYLLABUS

No.	Content	Hours	COs
I	**Introduction** Power quality, voltage quality – overview of power quality phenomena – classification of power quality issues – power quality measures and standards – THD-TIF-DIN-flicker factor-transient phenomena – occurrence of power quality problems – power acceptability curves – IEEE guides, EMC standards and recommended practices.	**06**	**CO1**
II	**Power Assessment under Waveform Distortion** Introduction – single phase definitions, three phase definitions – illustrative examples.	**06**	**CO2**
III	**Waveform Processing Techniques** Fundamental frequency characterization – Fourier analysis, Fast Fourier Transform, window functions, efficiency of FFT algorithms – alternative transforms, wavelet transform, Hartley transform – automation of disturbance recognition.	**05**	**CO4**
IV	**Power Quality Monitoring** Introduction, transducers, CT, PT – power quality instrumentation – Harmonic monitoring – event recording – flicker monitoring, assessment of voltage and current unbalance – examples of application	**05**	**CO3**
V	**Evaluation of Power System Harmonic Distortion** Introduction – direct harmonic analysis – incorporation of harmonic voltage sources – derivation of network harmonic impedances – solution by direct injection – representation of individual power system components – implementation of harmonic analysis – post processing and display of results.	**06**	**CO5**
VI	**Harmonic Mitigation** Passive filtering – harmonic resonance – impedance scan analysis – active power factor correction – introduction to three phase APFC and control techniques.	**04**	**CO6**
VII	**Grounding** Grounding and wiring – NEC grounding requirements, reasons for grounding – typical grounding and wiring problems – solutions to grounding and wiring problems.	**04**	**CO7**
Total Hours		**36**	

Essential Readings

1. Roger C. Dugan, Mark F. McGranaghan, Surya Santoso "Electrical Power System Quality", Tata Mcgraw-hill, New Delhi, 1st edition, 2012.

2. Math H Bollen, "Understanding Power Quality Problems: Voltage Sags and Interruptions", Wiley-IEEE Press, 1st edition, 1999.

3. Jos Arrillaga, Neville R. Watson, S. Chen, "Power System Quality Assessment", John Willey, 1st edition , 2000.

Supplementary Readings

1. Jos Arrillaga, Bruce C. Smith, Neville R. Watson, Alan R. Wood, "Power System Harmonic Analysis", John Wiley, 1st edition , 1997.

2. Roger C. Dugan, Surya Santoso, Mark F. McGranaghan, H. Wayne Beaty, "Electrical Power System Quality", McGraw Hills, 1st edition , 2002.