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

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

Course Code	Course Name	Pre-Requisite	Credit Structure				Marks Distribution			
			L	T	P	C	INT	MID	END	Total
EE413	**Wide Area Monitoring Systems**	**EE301**	**3**	**0**	**0**	**3**	**50**	**50**	**100**	**200**

Course Objectives	To introduce necessity for wide area measurements (WAM)		Course Outcomes	CO1	**Able to acquire knowledge about basic principles of wide are monitoring and control of power system**
	To teach various phasor estimation approaches			CO2	**Able to compute and analyze phasor of power system**
	To develop an ability and skill for development and application of wide area measurements (WAM)devices			CO3	**Able to compute system frequency under diverse conditions**
				CO4	**Able to apply wide area concepts in power system**
				CO5	
				CO6	

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	0	1	0	0	0	0	2	0	0	0	3	0	3
2	CO2	3	3	0	1	0	0	0	0	2	0	0	0	2	0	2
3	CO3	2	3	3	1	2	0	0	0	0	0	0	0	2	3	2
4	CO4	2	2	2	0	3	2	0	0	2	0	0	1	2	3	2

SYLLABUS			
No.	Content	Hours	COs
I	**Introduction** **Basic architecture; basic principles for wide area monitoring and control in real-time; dynamic modelling of synchronous generator; transient stability monitoring and control; small signal monitoring and control**	**06**	**CO1**
II	**Characterization of Phasor** **Fourier concepts and applications; sampling data and aliasing; phasor estimation of nominal frequency inputs; phasor estimation of off-nominal frequency inputs, single phase, multiphase, unbalanced systems, sequence components estimation**	**10**	**CO2**
III	**Frequency Estimation** **Historical overview; balanced three phase inputs; unbalanced inputs; non-linear frequency estimators; advanced frequency measurement techniques**	**06**	**CO3**
IV	**Phasor Measurement Units (PMU) and Phasor Data Concentrators** **Generic PMU, global positioning system, phasor measurement systems, communication system for PMU's, functional requirements for PMU's and PDC's**	**08**	**CO1** **CO2** **CO3**
V	**Phasor Measurement Applications** **Synchrophasor applications in power system protection and emergency control; optimal placement ofphasor measurement units; Real-time monitoring and control of voltage stability**	**06**	**CO4**
	Total Hours	**36**	

Essential Readings

1. A. G. Phadke and J. S. Thorp, "Synchronized Phasor Measurements and their Applications", Springer, 1st edition, 2008

2. M. Shadidehpour and Y. Wang, "Communication and Control in Electric Power System", Wiley, 1st edition, 2003

Supplementary Readings

1. P. Kundur, "Power System Stability and Control", Tata McGraw Hill, 1st edition, 2006

2. P. M. Anderson and A. A. Fouad, "Power System Control and Stability", Wiley, 3rd edition, 2019

3. H.D. Chiang, "Direct Methods for Stability Analysis of Electric Power Systems", Wiley, 0th edition, 0000