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

Programme	**Bachelor of Technology in Electrical and Electronics Engineering**	Year of Regulation	**2019-20**
Department	**Electrical Engineering**	Semester	**IV**

Course Code	Course Name	Credit Structure				Marks Distribution			
		L	T	P	C	INT	MID	END	Total
EE206	**Measurement& Instrumentation**	**3**	**0**	**0**	**4**	**50**	**50**	**100**	**200**

Course Objectives		Course Outcomes		
	To understand the use various measuring electronics instruments and measurement methods in electronic systems		CO1	**Ability to understand the performance characteristics of Measurement Systems with accuracy, precision and resolution**
	Development of the skills to define measurement parameters, standards, characteristics, errors		CO2	**Ability to know the importance of bridges networks (AC and DC) for the accurate measurement of various electrical parameters (R, L, C)**
	To build up the knowledge about the dynamics, operation, characteristics and use of various types of analog as well as digital instruments for a given applications		CO3	**Ability to understand the necessity and principle of operation of different indicating and integrating instruments for the measurement of current or voltage (DC & AC).**
	To develop an ability and skill to understand the basic concepts of general purpose oscilloscopes, DSO and recorders. Students should be able to measure different parameters such as voltage, frequency and phase angle of signal using CRO		CO4	**Ability to identify the necessity and utilization of instrument transformer in the protection circuits of power system for the operation of over current and under voltages and to gain knowledge on utilization and interpretation of various transducers along with their practical implementation.**
	Ability to understand the basics of data acquisition process		CO5	**Ability to understand the basics of data acquisition process and to understand the basic concepts of general purpose oscilloscopes, DSO and recorders.**
			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**	**3**	**0**	**0**	**1**	**2**	**0**	**0**	**1**	**3**	**0**	**3**
2	CO2	**3**	**3**	**3**	**2**	**3**	**0**	**0**	**1**	**2**	**0**	**0**	**1**	**3**	**3**	**2**
3	CO3	**2**	**3**	**3**	**1**	**2**	**2**	**2**	**0**	**0**	**0**	**0**	**0**	**2**	**3**	**2**
4	CO4	**2**	**2**	**3**	**0**	**2**	**2**	**3**	**0**	**2**	**0**	**0**	**1**	**2**	**3**	**2**
5	CO5	**2**	**2**	**3**	**2**	**2**	**2**	**3**	**1**	**2**	**0**	**0**	**1**	**3**	**3**	**3**
6	CO6	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

SYLLABUS

No.	Content	Hours	COs
I	**Performance Characteristics of Measurement Systems**: **Basics of Measurements: Accuracy, Precision, resolution, reliability, repeatability, validity, standards and calibration; noise, signal to noise ratio, errors in measurement. Input-output configuration of instruments and measurement systems. Static characteristic of measuring devices; Dynamic characteristics of instrumentation systems.**	**03**	**CO1**
II	**Measurement of Resistance, Inductance and Capacitance:** **Bridge Measurement: DC bridges- Wheatstone bridge. AC bridges-Kelvin's double bridge, Maxwell, Anderson, De-Sauty, Wien bridge, Schering bridge networks. Wagner earthling device.**	**08**	**CO2** **CO1**
III	**Indicating and Integrating Instruments:** **Construction and principle of operations of moving coil, electrodynamometer, moving iron, and Electrostatic type indicating instruments. Extension of instrument ranges using shunt, multipliers. Principle of operation of the thermoelectric and rectifier type instruments.**	**10**	**CO3** **CO1**
IV	**Instrument Transformers and Transducers** **Theory of current and voltage transformer, ratio error and phase angle, burden, turns compensation performance characteristics, testing and applications of CT and PT. Resistive, Inductive and Capacitive transducers, Piezoelectric transducer, photoelectric transducer and basic signal conditioning circuits for transducers.**	**08**	**CO4** **CO1**
V	**Analog & Digital Instruments:** **Electronic Instruments for Measuring Basic Parameters: Amplified DC meter, AC Voltmeter; True- RMS responding Voltmeter; Digital voltmeter and multimeter, Q-meter Voltmeter. CRO: operation; measurement of voltage, frequency and phase angle; Digital Storage Oscilloscope; Digital data Acquisition Systems.** **Digital display and recording devices: Bar graph display: seven segment and dot matrix display; signal recorders: XY recorders, digital recording and data loggers.**	**07**	**CO5** **CO3**
	Total Hours	**36**	

Essential Readings

1. A. K. Sawhney,"A course in Electrical & Electronic Measurements & Instruments", Dhanpat Rai and Co. Pvt. Ltd., 2015
2. A. D. Heltrick &W.D. Cooper, "Modern Electronic Instrumentation & Measuring Instruments" PHI, 1992
3. A. J. Bouwels "Digital Instrumentation", McGraw Hill, 1986.

Supplementary Readings

1. D Patranabis,"Principle of Industrial Instrumentation", TMH, 2nd Edition, 2008
2. H. S. Kalsi,"Electronic Instrumentation" Tata McGraw Hill, 3rd Edition, 2010.
3. Ernest O. Doebelin,"Measurement systems", Tata-McGraw Hill, 6th Edition, 2011
4. David A Bell,"Electronic Instrumentation and measurement", OUP, 3rd Edition, 2013

5. C. S. Rangan, Sharma,“Instrumentation – Devices & Systems” TMH, 2nd Edition, 2017