Course code	Course Name	L-T-P-Credits	Year of Introduction
IC203	**Electrical and Electronics Measurements**	3-1-0-4	2016

Prerequisite: Nil

Course Objectives
- *To understand the basic working principle of electrical and electronic measuring instruments*
- *To design and calibrate electrical measuring instruments*
- *To know the basics of developing an instrumentation system for a particular application*

Syllabus

Introduction to measuring instruments, types ,errors and compensation, Instrument transformers and its applications, Power and Energy measurements, frequency and power factor measurement, Measurement of resistance, magnetic measurement, Potentiometer Oscilloscope and digital measurement.

Expected outcome

At the end of the course the student will be able to
     (i) determine various types of errors in measurements
     (ii) use various measuring instruments for measuring electrical quantities.

Text Books

1. E.W. Golding and F.C. Widdis, Electrical Measurements and Measuring Instruments, Reem Publishers
2. A.K. Sawhney, *A course in Electrical and Electronics Measurements and Instrumentation*, Dhanpat Rai and sons
3. Joseph J Carr, *Elements of electronic Instrumentation and Measurement*, Pearson Education

References

1. William David Cooper, *Electronic Instrumentation and Measurement Techniques*, Prentice Hall, India
2. K.B. Klaassan, *Electronic Measurements and Instrumentation*, Cambridge University Press
3. John Bentley, *Principles of Measurements Systems*, Pearson Education

Course Plan			
Module	**Contents**	**Hours**	**Sem. Exam Marks**
I	Indicating Instruments: Principle-Types of controls (spring and gravity controls)-Types of Damping (eddy current, air friction, fluid friction),	4	15%
	Moving coil Instruments:-Types (permanent magnet, dynamometer type meters). Moving Iron Instruments-Attraction and repulsion type- Principles and torque equation	3	
	Classification of errors in indicating instruments and compensation	3	
II	Wattmeters: Dynamometer type wattmeter- Principles and torque equation-	2	15%
	Measurement of single phase and three phase power-true RMS meter. Errors and Compensation.	3	
	Current transformers and Potential transformers – Phasor diagram – ratio and phase angle errors – use of instrument transformers with wattmeter.	3	
FIRST INTERNAL EXAM			
III	Energy Meters: -Principle of working of ampere hour meter (AH mercury motor meter), single and three phase energy meters (principles and torque equation) – errors and compensation, static watt meters and energy meters principle and block diagram,	4	15%
		4	
		3	
	power factor meters (Dynamometer type –single and three phase), vibrating reed frequency meter		
IV	Measurement of resistance: Ohmmeter, Megger, Wheatstone bridge – Kelvin's double bridge.	3	15%
	AC bridges: Measurements of inductance using Maxwell and Anderson bridges –	3	
	Measurements of capacitance using Schering Bridge	1	
SECOND INTERNAL EXAM			

V	Magnetic measurements: Measurement of flux, magnetizing force and permeability –	3		
	Hibbert's magnetic standard – flux meter – Hall Effect gauss meter	2		
	Potentiometer: General principle - Modern form of dc potentiometers - Vernier dial principle - Standardization -	2	20%
	ac potentiometers - coordinate and polar types - Application of dc and ac potentiometers	3	
VI	Oscilloscope: Simple CRO- CRT-Control of CRO-Dual beam CRO-Dual Trace CRO- Storage	3		
	oscilloscope- Digital storage oscilloscope- Sampling Oscilloscope- measurement with CRO –	3		
	Digital methods of frequency, phase, time and period measurements. Digital voltmeter, q-meter.	4	20%
END SEMESTER EXAM				

QUESTION PAPER PATTERN:

  Maximum Marks :   100   Exam Duration: 3 Hours

Part A

Answer any two out of three questions from Module 1 and 2 together. Each question carries 15 marks and can have not more than four sub divisions.   (15 x 2 = 30 marks)

Part B

Answer any two out of three questions from Module 3 and 4 together. Each question carries 15 marks and can have not more than four sub divisions.   (15 x 2 = 30 marks)

Part C

Answer any two out of three questions from Module 5 and 6 together. Each question carries 20 marks and can have not more than four sub divisions.   (20 x 2 = 40 marks)

                                                                     Total 100 Marks

Note: Each part shall have questions uniformly covering both the modules in it.