Program : **Diploma in Electronics/ Electronics and Communication Engineering**	
Course Code : **4042**	Course Title: **Electronics Measurements& Instrumentation**
Semester :**4**	Credits: **4**
Course Category: **Program Core**	
Periods per week: **4 (L:3, T:1, P:0)**	Periods per semester:**60**

Course Objectives:

- To provide learning experience on characteristics of testing and measuring instruments.
- To introduce the basic features of oscilloscope, analyzers, and recorders.

Course Prerequisites:

Topic/Description	Course code	Course Title	Semester
Basic Engineering Mathematics principles and theorems		Mathematics I & II	1 & 2
Knowledge of current, voltage& magnetism		Applied Physics I & II	1 & 2
Representation of AC signals, voltage, current and power		Fundamentals of Electrical and Electronics Engineering	2

Course Outcomes:

On completion of the course, the student will be able to:

COn	Description	Duration (Hours)	Cognitive level
CO1	Explain the working principle of variousmeasuring Instruments	15	Understanding
CO2	Explain the working principle of CRT and CRO.	15	Understanding
CO3	Illustrate the working principle of bridges, signal generators and analysers.	16	Understanding
CO4	Explain the working of transducers and recorders	12	Understanding
	Series Test	2	

CO-PO Mapping:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2						
CO2	2						
CO3	2						
CO4	2						

3-Strongly mapped, 2-Moderately mapped, 1-Weakly mapped

Course Outline:

Module Outcomes	Description	Duration (Hours)	Cognitive Level
CO1	**Explain the working principle of various measuring instruments**		
M1.01	Summarize specifications of measuring instruments.	3	Remembering
M1.02	Explain the working principle and conversion of galvanometer into Voltmeter and Ammeter	4	Understanding
M1.03	Explain PMMC and MI instruments	4	Understanding
M1.04	Explain the working of analog and digital meters.	4	Understanding
Contents: **Measurements and Measuring Instruments** Static characteristics of an instrument-Accuracy &Precision, Resolution, Expected value, Sensitivity. Types of Errors- static errors-gross errors, systematic errors, random errors Construction and Working principle of Galvanometer and conversion into Ammeter & Voltmeter Permanent Magnet Moving Coil Instruments (PMMC) – construction and principle Moving Iron type Instruments (MI)- working and construction- both attraction type and repulsion type Electro Dynamo Type Instruments': construction and working; Analog- basic DC & AC voltmeter, Digital Voltmeter- ramp type, Digital Multimeters, Single-Phase Energy Meter			
CO2	**Explain the working principle of CRT and CRO.**		
M2.01	Illustrate construction and operation of CRT	4	Understanding
M2.02	Explain working of CRO	4	Understanding

M2.03	Summarize measurements using CRO	3	Understanding
M2.04	Explain block diagram and features of DSO	4	Understanding
	Series Test – I	1	

Contents:

Oscilloscopes

Cathode ray tube: construction, operation, screen materials, graticules, electrostatic focusing-Vertical deflection system, Horizontal deflection system, Delay line

Block diagram and working of CRO, applications

Multiple Trace CRO-definition, Dual trace Oscilloscope- block diagram and working

Procedure for Measurements using CRO- Voltage (DC and AC), time delay, frequency and phase angle by using Lissajous patterns

Digital Storage Oscilloscope- block diagram, features.

Oscilloscope probes: 1:1 and 10:1 probe- equivalent circuit and description

CO3	**Illustrate the working principle of bridges, signal generators and analysers.**		
M3.01	Explain AC and DC bridgesand Potentiometers	8	Understanding
M3.02	Summarize application of bridges	1	Understanding
M3.03	Explain working principle of function generator	3	Understanding
M3.04	Illustrate working of various types of analysers and Q-meter	4	Understanding

Contents:

Bridges, Analyzers.

DC Bridges:

Wheatstone bridge- resistance measurement - principle and analysis and problems related

Kelvin Double Bridge - measurement of low resistance – principle and analysis

AC Bridges: -

Maxwell's Inductance Bridge – measurement of low Q- principle and analysis

Hay's Bridge – measurement of high Q- principle and analysis

Applications of each bridge.

Potentiometers:

DC potentiometers- Basic slide wire DC potentiometer and Crompton's DC potentiometer – how to measure unknown emf, Applications

AC potentiometer – definition and basic requirements, applications

Basic signal generator –Basic block diagram, Function generator –block diagram, working,

applications

Wave analyzers – Basic wave analyzer- concept and circuit, spectrum analyzer – principle and block diagram with test waveforms, applications

Q – meter- Principle, resonant RLC circuit and Practical circuit diagram, Applications

CO4	**Explain the working of transducers and recorders.**		
M4.01	List types of transducers	3	Understanding
M4.02	Choose specific transducers for an application based on selection criteria.	3	Understanding
M4.03	Explain working of different types of transducers	3	Understanding
M4.04	Illustrate the basic concept of recorders and types	3	Understanding
	Series Test – II	1	

Contents:

Transducers and Recorders

Transducers- Classification, Selection Criteria, Characteristics

Construction, Working Principles and Application of following Transducers: Thermocouple, Thermistor, LVDT, Strain Gauge, Piezoelectric Transducers, Load Cell

Data recorders - basic concept, Block diagram of X-Y recorder and strip chart recorder, applications

Text / Reference:

T/R	Book Title/Author
T1	Electronic Instrumentation - H S Kalsi
T2	A Course in Electrical and Electronic Measurements and Instrumentation - A K Sawhney
T3	Electronics Measurements And Instrumentation- U.A Bakshi and A.V. Bakshi
R1	Electronic Instrument and measurement technique – W.D Cooper
R2	Electronic Measurement and Instrumentation – J.G JOSHI
R3	Electronics and Electrical Measurements and Instrumentation - J B Gupta - S K Kataria.
R4	Industrial Electronics and Control - Biswanath Paul.

Online reference:

Sl.No	Website Link
1	https://myclassbook.org/darsonval-meter-movement-principle/
2	https://www.electrical4u.com/cathode-ray-oscilloscope-cro/
3	https://www.tutorialspoint.com/electronic_measuring_instruments/electronic_measuring_instruments_transducers.htm
4	http://ei-notes.blogspot.com/2012/04/data-acquisition-system-das-with-neat.html
5	http://www.darshan.ac.in/Upload/DIET/Documents/EE/EMMI_Ch%206_13092018_031526AM.pdf