Program : **Diploma in Electrical & Electronics Engineering**	
Course Code : **3034**	Course Title: **Electrical & Electronic Measuring Instruments**
Semester : **3**	Credits: **4**
Course Category: **Program Core**	
Periods per week: **4 (L:3 T:1 P:0)**	Periods per semester: **60**

Course Objectives:

- To Follow standard measurements and measuring instruments.
- To recognize the instruments for each measurement and their connections.

Course Prerequisites:

Topic/Description	Course code	Course Name	Semester
Basics of electrical quantities and their units		Fundamentals of Electrical and Electronics Engineering	2

Course Outcomes

On completion of the course, the students will be able to:-

COn	Description	Duration (Hours)	Cognitive level
CO1	Identify different types of electrical measuring instruments and their operation.	14	Applying
CO2	Summarize appropriate methods for measurement of various electrical quantities	15	Understanding
CO3	Summarize the working of digital and special purpose meters for electrical measurements.	15	Understanding
CO4	Explain process control instruments and their applications	14	Understanding
	Series Test	2	

CO – PO Mapping

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3						
CO2	2						
CO3	2						
CO4	2						

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

Course Outline

Module Outcome	Description	Duration (Hours)	Cognitive Level
CO1	**Identify different types of electrical measuring instruments and their operation.**		
M1.01	Classify different types of electrical measuring instruments	3	Understanding
M1.02	Explain the production of torques in electrical instruments.	3	Understanding
M1.03	Illustrate the construction and working of PMMC and MI instruments.	3	Understanding
M1.04	Identify the methods for range extension of moving coil meters.	5	Applying
Contents: Methods of measurements-Direct-Indirect. Classification of instruments- absolute and secondary- -analog and digital- null and deflection type instruments -indicating- integrating-recording. Operating torques-Deflecting torque-Controlling torque-Damping torque. (Functions and method of production only). Working and construction - PMMC - MI type instruments- Comparison Range extension- Shunt and multipliers (simple problems).			
CO2	**Summarize appropriate methods for measurement of various electrical quantities.**		

M2.01	Classify different methods for measurement of resistance	4	Understanding
M2.02	Explain the methods for locating cable faults	3	Understanding
M2.03	Explain the working of AC bridges for measurement of inductance and capacitance	4	Understanding
M2.04	Illustrate the methods of power and energy measurements	4	Understanding
	Series Test -I	1	

Contents:

Measurement of resistance –Classification of resistance, methods of measurement of resistance - Ammeter-Voltmeter method-Wheatstone bridge (Derivation and circuit needed)

List the types of cable faults -Location of earth fault and short circuit fault in underground cables using Murray loop test.

Measurement of inductance-Maxwell's inductance Bridge(Derivation and circuit needed)
Measurement of capacitance-Schering bridge (no derivation and phasor diagram).

Dynamometer type wattmeter – construction and working.
Single phase Energy meter-Induction type (construction and working).

CO3	**Summarize the working of digital and special purpose meters for electrical measurements.**		
M 3.01	Explain the working of special purpose electrical instruments.	4	Understanding
M 3.02	Explain methods for measuring earth resistance and insulation resistance.	3	Understanding
M 3.03	Summarize the working of digital meters.	4	Understanding
M 3.04	Illustrate the working of CRO and DSO	4	Understanding

Contents:

Special purpose measuring instruments -working with diagram - Dynamometer type power factor meter (Single phase and three phase) - synchroscope (Weston type)-Phase sequence indicators (Static and dynamic types)- Frequency meter (reed type, electro resonance type)

Earth tester - insulation tester -basic concept and connection procedure

Digital meters - Working and block diagrams -Ramp type digital voltmeter-Digital frequency meter

Smart energy meters (Basic concept and Features only)

Waveform analysers-block diagram and applications-CRO-DSO.

CO4	**Explain process control instruments and their applications.**		
M 4.01	Explain transducers with their classification.	3	Understanding
M 4.02	Illustrate the measurement of various physical quantities	4	Understanding
M 4.03	Explain various tacho generators	4	Understanding
M 4.04	Summarize Data acquisition system.	3	Understanding
	Series test-II	1	

Contents:

Transducer- Definition- Basic requirements, -Classifications- Specifications.

Measurement using transducers- principle of operation- measurement of displacement using LVDT-temperature using Thermocouple- Thermistors(salient features and applications only)

Digital tachometers- dc and ac tacho generators(Basic concepts only)

Data acquisition system -(General block diagram only)

Text /Reference:

T/R	Book Title/Author
T1	Rajput R.K., "Electrical and Electronic Measurement Instrumentation", S.Chand and Co., NewDelhi, ISBN:9789385676017
T2	Sawhney A.K., "Electrical and Electronics Measurements and instrumentation" Dhanpai Rai and Sons, New Delhi, ISBN:9780000279744
T3	Prithwiraj Purkait, Budhaditya Biswas, "Electrical and Electronics Measurements and Instrumentation" (Kindle Edition)
T4	J.B. Gupta, "Electrical and Electronics Measurements & Instrumentation", S.K.Kataria & Sons, New Delhi.

Online Resources

Sl No	Website Link
1	https://www.academia.edu/8140873/A_K_Sawhney_A_course_in_Electrical_and_Electronic_Measurements_and_Instrumentation
2	https://en.wikipedia.org/wiki/List_of_electrical_and_electronic_measuring_equipment
3	NPTEL courses:https://nptel.ac.in/courses/108/105/108105153
4	https://nptel.ac.in/courses/108/105/108105053
5	Sensors and transducers https://nptel.ac.in/content/storage2/courses/112103174/pdf/mod2.pdf
6	Virtual Lab: http://vlabs.iitkgp.ernet.in/asnm/#
7	https://www.npl.co.uk/special-pages/guides/gpg132_engineering.aspx?ext=.
8	NPTEL channel:www.youtube.com/channel/UC640y4UvDAlya_WOj5U4pfA