GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT
COURSE CURRICULUM

Course Title: Basic Instrumentation
(Code: 3311701)

Diploma Programmes in which this course is offered	Semester in which offered
Instrumentation & Control Engineering	**First Semester**

1. RATIONALE

Any student of diploma in instrumentation engineering will be required to select various instrumentation devices when he reaches the industry. As most of the devices are electrical and electronics based products, the student is required to develop a basic understanding of the concepts and related terms of electricity, electronics, magnetism & electromagnetism and it is in this backdrop that this course has been designed.

2. COMPETENCY

The course content should be taught and implemented with the aim to develop different types of skills leading to the achievement of the following competency:

i. **Select and use the various instrumentation devices.**

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	
4	0	4	8	70	30	40	60	200

Legends: L-Lecture; **T** – Tutorial/Teacher Guided Student Activity; **P** - Practical; C – Credit;
ESE - End Semester Examination; **PA** - Progressive Assessment.

4. COURSE DETAILS

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit – I Basics of instrumentation	1a. Classify instruments used in the instrumentation industry 1b. Explain the basic terms related to instrumentation and control	1.1 Scope of Instrumentation in industries 1.2 Significance of Instrumentation & control. 1.3 Evolution of Instrumentation a Brief journey from manual control to automation b Simple block diagram of Instrumentation system c Basic terms related to instrumentation & control viz. process variable, system , control variable, error, input, output, feedback 1.4 a Definitions of characteristics of instruments & Measurement System Static: accuracy, sensitivity, resolution, precision, drift, dead

Unit	Major Learning Outcomes	Topics and Sub-topics
		zone, repeatability & reproducibility and Dynamic : Fidelity, speed of response, lag b Classification of Instruments based on Function, output, operation, nature of signals etc.
Unit– II Basic electricity	2.1Explain the basic terms related to electrical engineering 2.2Classify electrical measuring instruments	2.1 Terms related to basic electricity-Definitions of EMF, Current, Potential Difference, Power, Energy and Efficiency. 2.2 Definition: Resistance, resistivity & conductivity and their units 2.3 Factors affecting resistance 2.4 Ohm's law, Kirchhoff's Laws of current & voltage, Measurement of unknown resistance by Wheastone bridge(without derivation) 2.5 Terms related to A.C. (alternating current): Cycle, frequency, time period, Amplitude, average & RMS value. 2.6 Classification of electrical measuring instruments
Unit– III **Magnetism & electromagnetism**	3.1Explain the different laws related to electricity and magnetism 3.2Describe the working of NO and NC types of relays	3.1 Definition of magnetism, Types of magnets (Only examples) 3.2 Terms related to magnetism- Poles, magnetic lines of force, flux density, Reluctance, permeability, B-H curve, Hysteresis 3.3 Working principle of electromagnet, solenoid 3.4 Relays, Types- N.O. & N.C. 3.5 Self & Mutual induction, Statements of Faraday's first & second Laws of electromagnetic induction, Statements of Fleming's rules.
Unit– IV **Basic electronics**	4.1Describe the working of half and full wave rectifiers 4.2Select appropriate types of electronic filters 4.3 Explain the working of opamps and terms related to it.	4.1 Symbols, Terminal identification & List applications of various semiconductor devices- Diodes, Transistors, SCR,DIAC, TRIAC, UJT, GTO, IGBT 4.2 Simple block diagram of power supply 4.3 Introduction to single phase Rectifier- Half & Full wave (without derivation) 4.4 Introduction to filter circuit, List types of Filters 4.5 Introduction to voltage regulator, List types of regulators 4.6 Simple Block diagram, advantages & comparison of SMPS & UPS 4.7 OPAMP IC 741: Symbol, PIN diagram, Application (only List) Terms- Voltage gain, bandwidth, input impedance, output impedance
Unit– V **Essential parameters for instrumentation**	5.1Compare the different types of of flow measurements 5.2Describe the method of temperature and level measurements	5.1 Introduction to various process parameters: Definitions of Terms- Pressure, Flow, Level, temperature 5.2 List various pressure sensing elements 5.3 List various techniques for flow measurements 5.4 List various techniques for level measurements 5.5 List various techniques for temperature measurements
Unit– VI **Introduction to latest innovation in advanced industrial instrumentation**	6.1Explain the block diagram of DCS, PLC and industrial application of controllers	6.1 Simple block diagram of DCS (Introductory) 6.2 Simple block diagram of PLC (Primary level) 6.3 Introduction to industrial application of controllers (only List)

5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total
1.	Introduction to basics of instrumentation	10	2	6	2	14
2.	Basic electricity	12	4	6	2	14
3.	Magnetism & electromagnetism	10	2	6	2	14
4.	Basic electronics	10	2	6	2	14
5.	Introduction to essential parameters for instrumentation	07	2	4	1	07
6.	Introduction to latest innovation in advanced industrial instrumentation	07	2	5	0	07
	Total	**56**	**25**	**23**	**08**	**70**

Legends
R = Remembrance; U = Understanding; A = Application and above levels (Revised Bloom's taxomonoy)

6. SUGGESTED LIST OF EXERCISES/PRACTICAL/EXPERIMENTS

The exercises/practical/experiments should be properly designed and implemented with an attempt to develop different types of skills leading to the achievement of the competency. Following is the list of exercises/practical/experiments for guidance

S.No.	Unit No.	Practical Exercises/ Experiment
1		Study various laboratory equipments viz. power supply, CRO, Function generator, Multimeter etc.
2		Use Multimeter for measuring voltage, current & resistance.
3		Use CRO for measuring voltage, current & frequency.
4	II	Verify Ohm's law.
5	II	Verify Kirchhoff's current law.
6	II	Verify Kirchhoff's Voltage law.
7	II	Measure unknown resistance using Wheatstone bridge.
8	II	Measure resistance value of series combination of resistors.
9	II	Measure resistance value of parallel combination of resistors.
10	II	Obtain various parameters related to given A.C. waveform.
11	III	Demonstrate the working of electromagnet.
12	III	Demonstrate the working of solenoid.
13	III	Study relay & its operation.
14	IV	Select Diode, Transistor, SCR, DIAC, TRIAC, UJT from the given components & identify their terminals.
15	IV	Assemble half wave rectifier & measure output voltage waveform on CRO.
16	IV	Assemble Full wave rectifier & measure output voltage waveform on CRO.
17	IV	Connect filter circuit at the output of rectifier & measure output voltage waveform on CRO.
18	V	Study and use Pressure sensing elements,
19	V	Study and use Flow measuring instruments
20	V	Study and use level measuring instruments.
21	V	Study and use temperature measuring instruments.

S.No.	Unit No.	Practical Exercises/ Experiment
22	VI	Study block diagram of DCS.
23	VI	Study block diagram of PLC.
24	VI	Study applications of controllers.

NOTE: At least 16 experiments/practical exercises have to be performed form the above

7. SUGGESTED LIST OF PROPOSED STUDENT ACTIVITIES

Students are required to prepare and submit a laboratory report on instruction/demonstration given by instructor and workshop activities done by students as a part of term work.

8. SUGGESTED LEARNING RESOURCES

A. List of Books

Sr	Author	Title of Books	Publication
1.	Murthy D. V. S.	Transducers and Instrumentation	PHI Learning 2011
2.	Ernest Doebelin	Measurement Systems	Mcgraw hill Publishers
3.	Helfrick & Cooper	Modern Electronic Instrumentation & Measurement Techniques	PHI Learning
4.	Robert L. Boylestad, Louis Nashelsky	Electronic Devices and Circuit Theory	PHI Learning
5.	Patranabis	Sensors and Transducers	PHI Learning
6.	A.K. sawhney	A Course In Electrical And Electronic Measurements And Instrumentation	Dhanpat Rai & Sons.
7.	Bell, D.A.	Electronic Instrumentation and Measurements	PHI Learning 2011
8.	Carr, Joseph J.	Elements of Electronic Instrumentation and Measurements	Pearson Education, 2010
9.	S. K. Singh	Industrial Instrumentation & Control	Mcgraw hill Publishers
10.	R. K. jain	Electronic Instrumentation	Tata Mcgrawhill
11.	Kalsi, H.S.	Measurement Systems	Mcgraw hill Publishers 2011

B. List of Major Equipment/ Instrument:

Multimeter, Megger, Clamp-on meter, CRO, soldering iron, desoldering pump, pliers, cutters, L-end key, spanner(ring/open/box/adjustable),stripper, screw driver, pointer remover, tube bender, tube cutter, flaring tools etc.

C. List of Software/Learning Websites

i. http://www.instrumentationworld.com/instrumentation_tutorial.htm
ii. http://www.pc-education.mcmaster.ca/Instrumentation/go_inst.htm

9. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. M. K. Parikh**, HOD IC dept, Government Polytechnic, Ahmedabad
- **Prof. R. R. Manchiganti**, HOD IC dept, Government Polytechnic, Gandhinagar

- **Shri. A. K. Bilkhiya**, Lecturer IC dept, Government Polytechnic, Gandhinagar
- **Mrs. M. M. Mulchandani**, O.S.D., CEC, RCTI Campus, Ahmedabad
- **Shri. Ashvin M. Patel**, Lecturer IC Dept, Government Polytechnic, Palanpur
- **Shri. M. M. Shah**, Lecturer IC Dept, Government Polytechnic, Palanpur
- **Shri. S. K. Raval**, Lecturer IC Dept, Government Polytechnic, Ahmedabad
- **Shri. H. P. Patel**, Lecturer IC Dept, Government Polytechnic, Ahmedabad
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- **Shri. N. J. Dehalvi**, Lecturer IC Dept, Government Polytechnic, Gandhinagar
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