GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT
COURSE CURRICULUM

Course Title: Basic Physics (Group-2)
(Code: 3300005)

Diploma Programmes in which this course is offered	Semester in which offered
Electronics & Communication Engineering	**First Semester**
Biomedical Engineering,Computer Engineering,Electrical Engineering,Information Technology,Instrumentation & Control Engineering,Power Electronics Engineering,Printing Technology	**Second Semester**

1. RATIONALE

As Physics is the mother of all engineering disciplines, students must have some basic knowledge on physics to understand their core engineering subjects more comfortably. Accordingly, in reviewing the syllabus, emphasis has been given on the principles, laws, working formulae and basic ideas of physics to help them study the core subjects. Complicated derivations have been avoided because applications of the laws and principles of physics are more important for engineering students.

As Physics is considered as basic science, its principles, laws, hypothesis, concepts, ideas are playing important role in reinforcing the knowledge of technology. Deep thought is given while selecting topics in physics. They are different for various branches of engineering. This will provide sound background for self-development in future to cope up with new innovations. Topics are relevant to particular program and students will be motivated to learn and can enjoy the course of Physics as if it is one of the subjects of their own stream.

Engineering, being the science of measurement and design, has been offspring of Physics
that plays the primary role in all professional disciplines of engineering. The different streams of Physics like Optics, Acoustics, Dynamics, Semiconductor Physics, Surface Physics, Nuclear physics, Energy Studies, Materials Science, etc provide Fundamental Facts, Principles, Laws, and Proper Sequence of Events to streamline Engineering knowledge.

Note:- Teachers should give examples of engineering/technology applications of various concepts and principles in each topic so that students are able to appreciate learning of these concepts and principles.

Laboratory experiments have been set up keeping consistency with the theory so that the students can understand the applications of the laws and principles of physics.

2. LIST OF COMPETENCIES

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

- Select proper measuring instrument on the basis of range, least count & precision required for measurement.
- Analyze properties of material & their use for the selection of material mostly applicable for engineering users..
- Identify good & bad conductors of heat and proper temperature scale for temperature measurement
- Identify, analyze, discriminate and interpret logical sequence of field problems with the study of physics.
- Analyze variation of sound intensity with respect to distance.
- Follow the principles used in the physical properties, its measurement and selections.

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	
3	0	2	5	70	30	20	30	**150**

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

4. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit – I	*Explain Physical Quantities and their units. *Measure given dimensions by using appropriate instruments accurately. *Calculate error in the measurement *Solve numerical based on above outcomes	1.1 Need of measurement and unit in engineering and science, definition of unit , requirements of standard unit, systems of units-CGS,MKS and SI, fundamental and derived quantities and their units 1.2 Least count and range of instrument, least count of vernier caliper, micrometer screw gauge 1.3 Definition of accuracy, precision and error, estimation of errors - absolute error, relative error and percentage error, rules and identification of significant figures. (Numerical on above topics)
Unit– II	*State Coulomb's law, Ohm's law and Kirchhoff's law *Explain Electric field, potential and potential difference	2.1 Concept of charge, Coulomb's inverse square law, Electric field, intensity, potential and potential difference. 2.2 Electric current, Ohm's law, laws of series and parallel combination of resistance 2.3 D.C. circuits, Kirchhoff's law, heating effect & chemical

Unit	Major Learning Outcomes	Topics and Sub-topics
	*Define intensity, electric current, resistance *Apply laws of series and parallel combination to electrical circuits *Explain heating & chemical effect of current *Solve numerical based on above outcomes	effect of current (Numericals on above topics)
Unit– III	*Define magnetic intensity and flux and state their units *Distinguish between dia, para and ferro magnetic materials *Explain electromagnetic induction and its uses *State lenz's law *State applications of AC	3.1 Magnetic field and its units, magnetic intensity, magnetic lines of force, magnetic flux and their units 3.2 Dia, Para, Ferro magnetic materials 3.3 Electromagnetic Induction, Lenz's law and its Applications, Alternating current and its waveform
Unit– IV	*Define types of materials based on energy bands *Distinguish between intrinsic and extrinsic semiconductors *Explain p-n junction diode and its characteristics *State applications of diodes *state advantages of bridge rectifier over others * Explain types of transistors *Explain characteristics of transistors *Explain transistor operation in CE mode *State relation of current gain * Define nanotechnology and explain applications	4.1 Conductors, Insulators and Semiconductors, Energy bands, intrinsic and extrinsic semiconductors, Temperature dependence of conductivity, Superconductivity 4.2 p-n junction diode and its characteristics, Rectifier circuits - Full wave, half wave and bridge rectifiers (no design) 4.3 semiconductor transistor pnp and npn and their characteristics, transistor operation in CE mode, relation of current gain 4.4 Introduction to nanotechnology
Unit– V	*Explain wave and wave motion with example. *Distinguish between longitudinal and transverse waves *Explain propagation of sound in air. * State properties of light. *Define reflection, refraction polarization and diffraction *Explain physical significance of refractive index * Explain dispersion of light *State Properties of laser *Explain spontaneous and stimulated emission, population inversion and optical pumping *Explain construction and working of He-Ne laser *State applications of lasers. * Explain principle & working of optical fibres	Definition of wave motion, amplitude, period, frequency, and wavelength, relation between velocity, frequency and wavelength, longitudinal and transverse wave, principle of superposition of waves, definition of stationary wave , node and antinode, definition of resonance with examples, Formula for velocity of sound in air Properties Of Light, Electromagnetic spectrum, Reflection, refraction, snell's law, diffraction, polarization, interference of light, constructive and destructive interference (Only definitions), physical significance of refractive index, dispersion of light LASER, Properties of laser, spontaneous and stimulated emission, population inversion, optical pumping, construction and working of He-Ne laser, applications of lasers. Fibre Optics, Introduction, Total internal reflection, critical angle, acceptance angle, Structure of optical fibre, Numerical Aperture, Fiber optic materials, Types of optical fibres, Applications in communication systems.

Unit	Major Learning Outcomes	Topics and Sub-topics
	* State applications of optical fibres in communication systems	

5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total
1.	SI Units & Measurements	05	03	02	05	10
2.	Static & Current Electricity	10	05	05	08	18
3.	Electromagnetism & AC Current	08	04	05	03	12
4.	Semiconductors & Nano-technology	10	06	06	05	17
5.	Sound, Laser & Optical Fiber	09	04	06	03	13
	Total	**42**	**22**	**24**	**24**	**70**

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

6. SUGGESTED LIST OF EXPERIMENTS

The experiments should be properly designed and implemented with an attempt to develop different types of skills leading to the achievement of the competency - **……..**

S. No.	Unit No.	Experiment
1	1	To Measure linear dimensions by vernier caliper and calculate volume
2	1	To Measure linear dimensions by Micrometer screw
3	2	To calculate resistance using Ohm's law
4	2	To verify law of Resistance in series and parallel
5	2	To find unknown resistance through whetstone bridge
6	3	To determine A.C. frequency with the help of sonometer
7	1,2	To determine errors in electrical measurements
8	5	To determine the divergence of He-Ne laser beam.
9	3	To Measure A.C. Power using resistive load
10	3	Measurement of Energy
11	4	To study p-n junction in forward bias
12	4	To calculate SA/V ratio of simple objects to understand nanotechnology

- Hours distribution for Physics Experiments :

  Minimum 8 experiments should be performed from the above list

Sr. No.	Description	Hours
1	An introduction to Physics laboratory and its experiments (for the set of first four experiments)	02
2	Set of first four experiments	08
3	An introduction to experiments (for the set of next four experiments)	02
4	Set of next four experiments	08
5	Mini project	06
6	Viva and Submission	02
	Total	28

7. SUGGESTED LIST OF PROPOSED STUDENT ACTIVITIES

Following is the list of proposed student activities like:

Laboratory based mini projects :

1. To calculate acoustics of given class room
2. To measure diameter and calculate resistance of given set of conductors

Teacher guided self learning activities :

1. To prepare a chart of applications of nanotechnology in engineering field
2. To prepare models to explain different concepts

Course/topic based seminars :

1. Seminar by student on any relevant topic

8. SUGGESTED LEARNING RESOURCES

A. List of Books

S.No.	Author	Title of Books	Publication
1	Sears And Zemansky	University Physics	Pearson Publication
2	Paul G Hewitt	Conceptual Physics	Pearson Publication
3	Halliday & Resnick	Physics	Wiley India
4	G Vijayakumari	Engineering Physics, 4e	Vikas-Gtu Students' Series
5	Arvind Kumar & Shrish Barve	How And Why In Basic Mechanics	Universities Press
6	Ncert	Physics Part 1 And 2	Ncert

S.No.	Author	Title of Books	Publication
7	Giancoli	Physics For Scientists And Engineers	
8	H C Verma	Concepts Of Physics	
9	Gomber & Gogia	Fundamentals Of Physics	Pradeep Publications, Jalandhar

B. List of Major Equipment/ Instrument

1. Digital Vernier Calipers And Micrometer Screw Guage
2. Whetstone's Bridge
3. He – Ne Laser Instrument
4. Digital Energy Meter
5. Resistance Box
6. Battery Eliminator
7. Digital Millimeters

C. List of Software/Learning Websites

1. www.physicsclassroom.com
2. www.physics.org
3. www.fearofphysics.com
4. www.sciencejoywagon.com/physicszone
5. www.science.howstuffworks.com

9. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

1. Dr. S. B. Chhag, Lecturer in Physics, Science Deptt, Govt. Polytechnic, Rajkot
2. Ku. B. K. Faldu, Lecturer in Physics, Science Deptt, Govt. Polytechnic, Ahmedabad
3. Shri D. V. Mehta, Lecturer in Physics, Science Deptt, RCTI, Ahmedabad
4. Shri S. B. Singhania, Lecturer in Physics, Science Deptt, Govt. Polytechnic, Ahmedabad
5. Dr. U. N. Trivedi, Lecturer in Physics, Science Deptt, RCTI, Ahmedabad

Coordinator and Faculty Member From NITTTR Bhopal

1. Dr. P. K. Purohit, NITTTR, Bhopal

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM

Course Title: Industrial Transducers
(Code: 3321701)

Diploma Programmes in which this course is offered	Semester in which offered
Instrumentation and Control Engineering	Second Semester

1. RATIONALE

Transducers are used in almost every industry and also in everyday life. Therefore, a diploma engineer in Instrumentation and Control Engineering is expected to use, installed and test the functioning of the different types of transducers being used for measuring non-electrical quantities in the industry. The course is intended to develop the basic understanding as well as the competency to install and test various transducers and sensors for measuring displacement, temperature, radiation, pressure, flow, level, pH, conductivity, density, velocity, viscosity and such others.

2. COMPETENCY

The course content should be taught and implemented with the aim to develop different types of skills so that students are able to acquire following competency:

i. **Install/test different types of transducers.**

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	
3	0	2	5	70	30	20	30	150

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

Note: It is the responsibility of the institute heads that marks for **PA of theory** & **ESE and PA of practical** for each student are entered online into the GTU Portal at the end of each semester within the dates specified by GTU.

4. DETAILED COURSE CONTENT

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit – I Transducer Basics	1a. State the basic requirements of transducers 1b. Classify and list the different types of Transducer 1c. Compare properties context to transducers	1.1 Basic requirements of transducers 1.2 Classification based on transduction phenomenon, type of application, types of input and output signal, electrical principle involved i) Active and passive transducer ii) Based on application iii) primary and secondary transducers iv) analog and digital transducer
	1d. Describe the static characteristics of transducers	1.3 Static characteristic - accuracy, precision, error, linearity, reproducibility, repeatability, threshold, dead zone, hysteresis, creep, span, range.
	1e. Describe the dynamic characteristics of transducers	1.4 Dynamic characteristic (fidelity), speed of response, lag, dynamic error
Unit– II Electrical Transducers	2a.Describe working principle of different types of electrical transducers. 2.b Describe the basic construction of different types of transducers 2.cTest the listed transducers	2.1 Resistive Transducers, Inductive Transducers, LVDT, RVDT i) Capacitive Transducers. ii) Piezoelectric Transducers. 2.2 Strain Gauge Transducers (unbonded and bonded)
Unit– III Thermoelectric Transducers	3a. Describe working principle of different types of thermo-electric transducers . 3b. Describe the basic construction of listed types of transducers 3c. Test the listed transducers	3.1 Thermocouple (E,J,K,R,S,T,M,N,B,C, types) 3.2 RTD (Pt, Cu, Ni types) 3.3 Thermistor and semiconductor sensors
Unit– IV Electro-optical and Radio Acoustic Transducers	4a. Describe working principle of different types of electro optical transducers 4b. State the salient features of different types of transducers 4c. Test the listed transducers	4.1 Opto-electronic devices: Photo emissive cells, LED, LCD, LDR, IR emitter, Photoconductive cells, Photodiode, Photo transistor, Photovoltaic cells, LASER, Opto-coupler 4.2 Digital Encoders (incremental/absolute)
	4.c Describe working principle of radioactive acoustic and ultrasonic transducers	4.3 Radioactive acoustic transducers, Geiger Muller counter 4.4 Ultrasonic transducers 4.5 Ion Selective Electrodes
Unit– V Industrial Primary Transducers	5a. Describe working principle of flow transducers. 5b. Describe the basic construction of	5.1 Flow Transducers – Orifice (Concentric, Eccentric Segmental, Quadrant), Venturi, Flow nozzle, Pitot tube, Flapper nozzle. 5.2 Level Transducers – Float type, Displacement type, Bubbler.

Unit	Major Learning Outcomes	Topics and Sub-topics
	different types of transducers 5c. State the salient features of different types of transducers 5d. Test the listed transducers	5.3 Pressure Transducers – Bellows, diaphragm (flat, corrugated, capsule), Bourdon tube (C type, spiral, helical), Swirl & de swirl, Proving ring, Piston cylinders. 5.4 Temperature Transducers – Bimetallic Thermometers, Filled system Thermometers 5.5.1 Magnetic flowmeter 2. Mass flowmeter 3. Radar level transmitter 4. Ultrasonic level transmitter 5. Displacer type level transmitter

5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Transducer Basics	06	08	06	00	14
II	Electrical transducers	8	02	08	02	12
III	Thermoelectric Transducers	8	02	06	02	10
IV	Electro-optical and Radio Acoustic Transducers	8	02	08	02	12
V	Mechanical Transducers	12	02	14	06	22
	Total	**42**	**16**	**42**	**12**	**70**

Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)

Note: This specification table shall be treated as only general guideline for students and teachers. The actual distribution of marks in the question paper may vary from above table.

6. SUGGESTED LIST OF EXPERIMENTS

The experiments should be properly designed and implemented with an attempt to develop different types of skills leading to the achievement of the above mentioned expected competency.

Sr. No.	Unit No.	Practical Exercise/Experiment	Approx. Hrs. Required
1	II	Test & plot characteristic (Vibration Vs Voltage) of piezo-electric crystal.	01
2	II	Test & plot characteristic of resistive transducers.	01
3	II	Test & plot characteristic of inductive transducers.	01
4	II	Test & plot characteristic (Strain Vs Resistance) of strain gauge.	01
5	III	Test & plot characteristic (Temperature Vs Voltage) of thermocouple (J,K,R,S,T,M,N,B,E).	02
6	III	Test & plot characteristic (Temperature Vs Resistance) of resistance temperature detector (Pt-100, Pt-1000).	02
7	III	Test & plot characteristic (Temperature Vs Resistance) of given thermistor.	02
8	IV	Test & plot characteristic (Luminance Vs Resistance) of LED.	01

Sr. No.	Unit No.	Practical Exercise/Experiment	Approx. Hrs. Required
9	IV	Test & plot characteristic (Luminance Vs Resistance) of IR emitter.	01
10	IV	Test & plot characteristic (Luminance Vs Resistance) of LDR.	01
11	IV	Test & plot characteristic (Luminance Vs Current) of photodiode.	01
12	IV	Test & plot characteristic (Luminance Vs Current) of phototransistor.	01
13	IV	Test & plot characteristic of Opto coupler.	01
14	V	Test & plot characteristic (Flow rate Vs Differential Pressure) of various orifices.	02
15	V	Test & plot characteristic (Flow rate Vs Pressure) of nozzle.	02
16	V	Test & plot characteristic (Flow rate Vs Differential Pressure) of venturi.	01
17	V	Test & plot characteristic (Flow rate Vs Differential Pressure) of Pitot tube.	01
18	V	Test & plot characteristics of various level transducers.	02
19	V	Test & plot characteristic (Pressure Vs Linear Displacement) of C type bourdon tube.	01
20	V	Test & plot characteristic (Pressure Vs Linear Displacement) of bellows.	01
21	V	Test & plot (Pressure Vs Linear Displacement) characteristic of diaphragm.	01
22	V	Test & plot characteristic (Temperature v/s Displacement) of bimetallic thermometer.	01
		Total	**28**

7. SUGGESTED LIST OF PROPOSED STUDENT ACTIVITIES

7.1 Students may be given exercises based on transducers to calculate important terms related to above topics.

7.2 Students may be asked to collect photographs using internet which is relevant to field application of various topics & have to prepare learning materials using it.

7.3 Teachers guided self learning activities, industrial visit, Course/library/internet/lab based mini projects etc.

7.4 Students activities like: course/ topic based seminars, Internet based assignments.

8. SUGGESTED LEARNING RESOURCES

A. List of Books

Sr.No.	Author	Title of the Book	Publication/Year
1	Sawhney, A. K.	Electrical & Electronic Measurements and Instrumentation	Dhanpat Rai & Co., 2005 or later Edition
2	Murty, D. V.	Transducers and Instrumentation	Prentice Hall of India, 2005 or later Edition
3	Jain, R. K.	Mechanical and Industrial measurements	Khanna Publishes, 2005 or later Edition
4	Rangan, Sharm, Mani	Instrumentation Devices and Systems	Tata McGraw Hill, 2005 or later Edition
5	Kalsi, H. S.	Electronic Instrumentation	Tata McGraw Hill, 3rd or later Edition
6	B.G. Liptak	Instrument Engineers' Handbook, Fourth Edition, Volume 1,2	CRC press

B. List of Major Equipment/ Instrument

8.1 Function generator(sine, square, triangle etc.with frequency range 10 Hz to 100 kHz)
8.2 DC power supply (-30 →0→+30 V with at least 1A current capacity)
8.3 Measuring equipments like CRO (preferably dual channel, 20Mhz)
8.4 Multimeter
8.5 Circuit/Trainer board/ Demonstration modules of relevant transducers.

C. List of Software/Learning Websites

1 http://en.wikipedia.org/wiki/Transducer
2 http://www.instrumentationtoday.com/

9. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnic

1 **Prof. R.J.Dhruv,** I/C HOD IC ENGG., A.V. Parekh Technical Institute, Rajkot
2 **Prof. R.P.Raiyani**, I/C HOD IC ENGG., Christ Polytechnic Institute, Rajkot
3 **Prof. N.B.Mehta**, LECTURER IC ENGG., Government Polytechnic, Ahmedabad
4 **Prof. H.P.Patel**, LECTURER IC ENGG., Government Polytechnic, Ahmedabad

Co-ordinator and Faculty Member from NITTTR Bhopal

1. **Dr. Joshua Earnest,** Professor and Head, Dept. of Electrical & Electronics Engg,
2. **Prof. A.S.Walkey**, Associate Professor, Dept. of Electrical & Electronics Engg,

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM

Course Title: Instrumentation Devices and Components
(Code: 3321703)

Diploma Programmes in which this course is offered	Semester in which offered
Instrumentation and Control Engineering	Second Semester

1. RATIONALE

In the present industrial scenario, it is desired that diploma engineering students should be able to identify, classify and troubleshoot various electronic components, amplifiers and oscillators used in different instrumentation systems. Therefore, this course has been designed to take care of this need.

2. COMPETENCY

The course content should be taught and implemented with the aim to develop different types of skills so that students are able to acquire following competency:

i. **Use different types of instrumentation components and 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	200
4	0	4	8	70	30	40	60	

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

Note: It is the responsibility of the institute heads that marks for **PA of theory** & **ESE and PA of practical** for each student are entered online into the GTU Portal at the end of each semester within the dates specified by GTU.

4. DETAILED COURSE CONTENT

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit –I Passive Components for Instrumentation	1a. Define the terms R, L, C, X, Z 1b. Determine value of R, L,C in various circuits	1.1 Resistance, Inductance, Capacitance, Reactance, Impedance. 1.2 Series and Parallel combination of passive components
	1c. Compare the features of RL, RC and RLC circuits and their application as integrator and differentiator	1.3 RL, RC and RLC circuits and their application as integrator and differentiator
	1d. Describe working principle of transformer. 1e. State the need for fuse, Contactor and switch 1f. Name the different types of Fuses, Contactors and switches	1.4 Transformers : step-up, step-down, auto, Isolation and Control transformers 1.5 Miscellaneous devices: fuse, wired and glass (slow blow, fast blow, resettable, FRC). i) Contactors: 1- phase and 3-phase ii) Switches: SPDT, DPDT, 1-NO,1-NC, Iron clad, Reed, Limit
Unit– II Active Components for Instrumentation	2a. Classify 2, 3, 4-layer semiconductor devices	2.1 Two, Three and Four layer Semiconductor devices.
	2b. Describe the working principle of PN junction and zener diode 2c. Plot output characteristics of PN junction and zener diode. 2d. Test terminals of the given semiconductor devices 2e. List applications of given semiconductor devices	2.2 Two terminal devices viz. diodes (PN junction, Zener, Varactor diode, photo diode, Light emitting diode, schottky diode, Varistor, PIN diode, IMPATT, Tunnel diode, crystal diode, Gunn diode, Laser diode, DIAC.
	2f. Describe the working principle of NPN transistor 2g. Test terminals of the given semiconductor devices 2h. List applications of given semiconductor devices	2.3 Three terminal devices: NPN, PNP; JFET, MOSFET, Power transistor, Darlington transistor
Unit–III Feedback Amplifiers and Oscillators	3a. Describe the concept of different types of feedback with their applications. 3b. Compare types of feed back	3.1 Feedback (Positive , Negative)
	3c. Describe working of CE NPN Amplifier. 3d. Compare the various amplifiers based on biasing, coupling and application	3.2 BJT Amplifier based on: i) CE,CB and CC Amplifier ii) Biasing: Class A, Class B, class C iii) Coupling :RC, Transformer, Direct iv) Application: AF, RF and Instrumentation

Unit	Major Learning Outcomes	Topics and Sub-topics
	3e.List requirements for oscillations. 3f. Classify oscillators 3g.List applications of different types of oscillators.	3.3 Oscillators**:** RC-Phase-shift, Colpitts, Hartley, Crystal Oscillator, Wein bridge Oscillator etc.
Unit– IV Operational Amplifier	4a. Describe the functions and characteristics of operational amplifier. 4b.Describe the application of OPAMP.	4.1 Ideal OP-AMP, block diagram Characteristics, Differential gain, Common mode gain, CMRR, Slew rate, Gain- bandwidth product, virtual ground concept Operation of OPAMP with and without negative feedback. 4.2 Inverting, non-inverting and unity gain amplifier, integrator, differentiator, comparator, summing amplifier, logarithmic amplifier, voltage to frequency converter, frequency to voltage converter, instrumentation amplifier.
Unit – V Instrumentation Components, Indicators, Recorders and encoders.	5a.Describe the working of various types of indicators, recorders, actuators and encoders	5.1. Indicators, plotters, Recorders 5.2. Valve, actuator, valve positioner, filled systems, relay, digital encoders and decoders.
	5b.Describe basic working and respective characteristics of given instrumentation components.	5.3 Bourdon tube, bellows, Diaphragms, capsules, swirl & de swirl, proving ring, piston cylinders, Flapper Nozzle, Pneumatic relay.
	5c.List application of given instrumentation components.	5.4 Regulators and lubricators, thermo wells, floats, plum bobs, displacers, elbow taps, orifice plates, Venturi tube, Pitot tube, flow nozzles, Proving ring.
	5d.List color code of different extension leads of thermocouples.	5.5 All types of Thermocouple leads
	5e.List applications of given instrumentation components. 5f.Test given instrumentation components.	5.6 Proximity sensor: Inductive, Capacitive and Optical. 5.7 Limit switch & Safety switches: level, flow, displacement, pressure, temperature, and speed.

5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks (Duration – 56 Hours)			
			R Level	U Level	A Level	Total
I	Passive Components for Instrumentation	10	5	6	4	15
II	Active Components for Instrumentation	12	8	6	4	18
III	Feedback Amplifiers and Oscillators	10	4	6	2	12
IV	Operational Amplifier	14	7	6	2	15
V	Instrumentation Indicators, Recorders and Encoders	10	2	6	2	10
	Total	**56**	**26**	**30**	**14**	**70**

Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)

Note: This specification table shall be treated as only general guideline for students and teachers. The actual distribution of marks in the question paper may vary from above table.

6. SUGGESTED LIST OF EXERCISES/PRACTICALS

The experiments should be properly designed and implemented with an attempt to develop different types of skills leading to the achievement of the above mentioned expected competency.

S.No.	Unit No.	Practical Exercise	Approx Hours Required
1.	I	Measure value of resistance, capacitance & inductance of the given passive components.	02
2.	I	Measure value of the impedance of the given RL, RC & RLC circuits.	06
3.	I	Measure value of Series and parallel combination of Resistors.	02
4.	I	Measure value of Series and parallel combination of inductors & capacitors.	04
5.	I	Build differentiator circuit and obtain output for various types of test input signals.	02
6.	I	Build/test integrator circuit and obtain output for various types of test input signals.	02
7.	I	Identify following components viz. Transformers, Fuses, Contactors and Switches.	02
8.	I	Test following components viz. Transformers, Fuses, Contactors and Switches.	06
9.	II	Identify various types of 2, 3 & 4 layer semiconductor devices.	02
10.	II	Test the performance of PN junction diode & plot it's VI characteristics.	02
11.	II	Test the performance of various 2 terminal semiconductor devices & plot their VI characteristics.	06
12.	III	Test the performance of CE transistor configuration as an amplifier.	02
13.	III	Obtain the frequency response of CE amplifier.	02
14.	III	Build various oscillator circuits and measure their output frequencies.	06

15.	IV	Build the inverting and non-inverting amplifier using OPAMP and test their performance characteristics.	04
16.	IV	Test the performance of OPAMP as Instrumentation Amplifier	02
17.	IV	Test the performance of OPAMP as integrator and differentiator.	02
18.	IV	Test the performance of OPAMP as voltage to frequency and frequency to voltage converter.	02
19.	IV	Test the performance of OPAMP as unity gain amplifier.	02
20.	IV	Test the performance of OPAMP as logarithmic amplifier.	02
21.	IV	Test the performance of OPAMP as comparator.	02
22.	V	Test the performance of instrumentation components like Valve and actuators.	04
23.	V	Verify the output of a digital encoder and decoder.	02
24.	V	Test the performance of instrumentation components like Bourdon tube, bellows, Diaphragms & capsules.	04
25.	V	Test the performance of instrumentation components like proximity sensors & limit switches.	06
		Total	**78**

7. SUGGESTED LIST OF STUDENT ACTIVITIES

7.1 Students may be given exercises based on various instrumentation devices and components to calculate important terms related to above topics.
7.2 Students may be asked to collect photographs using internet which is relevant to field application of various topics & have to prepare learning materials using it.
7.3 Teachers guided self learning activities, Course/library/internet/lab based mini projects, industrial visit etc.
7.4 Students activities like: course/ topic based seminars, Internet based assignments.

8 SUGGESTED LEARNING RESOURCES

A. List of Books

S.No.	Author	Title of Books	Publication/Year
1	Sawhney A K	Electrical and Electronic Measurement and Instrumentation	Dhanpat Rai and Sons
2	Jain R K	Mechanical and Industrial Measurement	Khanna Publishers
3	Robert L. Boylestad, Louis Nashelsky	Electronic Devices and Circuit Theory	Pearson/Prentice Hall, 2009
4	Arun K. Ghosh	Introduction to Instrumentation & control	Prentice Hall, 2005
5	Jones E. B.	Instrument Technology, Vol - I, II	Hollywell
6	H. S Kalsi	Electronic Instrumentation	TMH 2010
7	R Gaikwad	Operational Amplifiers and applications	PHI latest edition

B. List of Major Equipment/ Instrument

8.1 Function generator(sine, square, triangle etc.with frequency range 10 Hz to 100 kHz)
8.2 DC power supply (-30 →0→+30 V with at least 1A current capacity)
8.3 Breadboard

8.4 Various types of Transformers, Fuses, Contactors, Switches, transistors, diodes, resistors, OPAMP ICs, Thyristors, UJT, Optoelectronic components, Bourdon tube, Bellows, Diaphragms, Regulators and lubricators ,Flapper nozzle, Thermocouples, Proximity sensors.

8.5 Measuring equipments like CRO (preferably dual channel, 20Mhz)

8.6 Multi meter

8.7 Circuit/Trainer board/ Demonstration modules of relevant components & devices.

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C. List of Software/Learning Websites

1 http://en.wikipedia.org

2 http://en.wikipedia.org/wiki/Transistor

3 http://www.mikroe.com/old/books/keu/04.htm

4 http://www.allaboutcircuits.com/vol_3/chpt_4/1.html

5 http://www.polyera.com/basic-devices/organic-thin-film-transistors

6 http://transistorhistory.50webs.com/xstr.html

7 http://www.radio-electronics.com/info/data/semicond/bipolar-transistor-bjt/transistors-basics-tutorials.php

8 http://hyperphysics.phy-astr.gsu.edu/hbase/electronic/diodecon.html

9 http://www.tpub.com/neets/book7/25.htm

10 www.wisc-online.com/objects/index.asp?objID=SSE3103

11 http://itee.uq.edu.au/~engg2800/Lecture%20Notes/Opamps.pdf

12 http://www.wisc-online.com/objects/ViewObject.aspx?ID=SSE3103

13 http://en.wikipedia.org/wiki/Electronic_oscillator

14 http://en.wikipedia.org/wiki/Thermocouple

15 http://en.wikipedia.org/wiki/Operational_amplifier

16 http://sharingmatrix.com/file/13056281/Electronic_Devices_and_circuit_theory.rar

17 http://uploading.com/files/cmmb535c/Electronic%2BDevices%2Band%2Bcircuit%2Btheory.rar/

9. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnic

1 **Prof.R.R. Manchiganti**, HOD IC ENGG., Government Polytechnic, Gandhinagar

2 **Prof. R. P. Merchant**, HOD IC ENGG., Government Polytechnic, Gandhinagar

3 **Prof. Ashvin M. Patel**, I/C HOD IC ENGG, Government Polytechnic, Palanpur

4 **Prof. M V Dabhi,** Lecturer IC ENGG., Government Polytechnic, Gandhinagar

5 **Prof. A K Bilakhia**, Lecturer IC ENGG, Government Polytechnic, Gandhinagar

Co-ordinator and Faculty Member from NITTTR Bhopal

1 **Dr.(Ms) C.S.Rajeshwari**, Professor, Dept. of Electrical & Electronics Engg.

2 **Dr.(Mrs) Anjali**, Assistant Professor, Dept. of Electrical & Electronics Engg.

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM

Course Title: Instrument Configuration Practices
(Code: 3321704)

Diploma Programmes in which this course is offered	Semester in which offered
Instrumentation and Control Engineering	Second Semester

1. RATIONALE

In instrumentation engineering the instruments of a given process loop will have to be configured with the help of relevant operating systems and networking technology. Therefore this course has been designed to achieve this objective for which the student will also have to understand the programmable instrumentation devices, installation of associated software troubleshooting as prescribed by the respective manufacturer.

2. COMPETENCY

The course content should be taught and implemented with the aim to develop different types of skills so that students are able to acquire following competency:

i. **Configure the instruments of a given instrumentation process loop with the help of relevant operating systems.**

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	
0	0	4	4	0	0	40	60	100

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

Note: It is the responsibility of the institute heads that marks for **PA of theory** & **ESE and PA of practical** for each student are entered online into the GTU Portal at the end of each semester within the dates specified by GTU.

4. DETAILED COURSE CONTENT

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit – I Networking Technology and Internet	1a. Identify devices and components needed for networking	1.1 Basic concept of Networking 1.2 Various topologies of Local Area Networks (LANs)
	1b. Install the various software and search engines required for networking	1.3 Uniform Resource Locator (URL) 1.4 Installation and configuration of Local Area Networks (LANs) and Internet 1.5 Basic features of Web browser, technical web browsers: Internet explorer, Mozilla Firefox, Google chrome etc.
Unit– II Installation of Thermal and flow measuring instruments	2a. Explain the working principle of various thermal instruments	2.1 Thermocouple, RTD 2.2 Filled System Thermometer, Bimetallic Thermometer
	2b. Explain the working principle of various flow measuring devices	2.3 Orifice plate, Venturi tube, Pitot tube, Rotameter
Unit– III Pressure measuring devices	3a. Explain the working principle of various pressure measuring devices	3.1 Bourdon tube, Bellows, Diaphragm, Differential pressure transmitter (DPT)
Unit-IV Configuration	4a. Configure installed instruments in a process loop	4.1 Concept of configuration, configuration of level loop, 4.2 Basic configuration of pressure loop, temperature loop, flow loop
Unit-V Calibration	5a. Calibrate the installed instrumentation devices	5.1 Need of calibration 5.2 Calibration of: i) Thermal devices (thermocouple, RTD, filled system) ii) flow devices (Rotameter, Orifice) iii) pressure devices (DPT, Bourdon tube type pressure gauge, diaphragm) iv) level measuring devices (float type)

5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

----------Not applicable----------

6. SUGGESTED LIST OF EXERCISES/PRACTICALS

The experiments should be properly designed and implemented with an attempt to develop different types of skills leading to the achievement of the above mentioned expected competency.

Sr.No.	Unit No.	Practical Exercise	Approx. Hours Reqiored
1	I	Connect Switches and Routers.	2
2	I	Trace LAN- STAR Topology	2
3	I	Trace LAN- TREE Topology	2
4	I	Trace LAN- BUS Topology	2
5	I	Install and Test INTERNET and WEB Browsers.	4
6	II	Install and Test Thermocouple with Well	4
7	II	Install and Test Thermocouple without Well	2
8	II	Install and Test 2 wire RTD	4
9	II	Install and Test 3 wire RTD	2
10	II	Install and Test 4 wire RTD	2
11	II	Install and Test Filled System Thermometer	4
12	II	Install and Test Bimetallic Thermometer	2
13	II	Install and Test Concentric Orifice with Flanged Taps	4
14	II	Install and Test Concentric Orifice with Venacontracta Taps	2
15	II	Install and Test Concentric Orifice with Piped Taps	2
16	II	Install and Test Venturi Tubes with Flanged Taps	4
17	II	Install and Test Venturi Tubes with Venacontracta Taps	2
18	II	Install and Test Venturi Tubes with Piped Taps	2
19	II	Install and Test Pitot Tubes	4
20	III	Install and Test pressure measuring devices	2
21	IV	Configure DPT	2
22	IV	Configure Level Switch (Float Type)	2
23	IV	Configure Temperature Switch	2
24	V	Calibrate RTD	2
25	V	Calibrate Thermocouple	2
26	V	Calibrate Bourdon Gauge	2
27	V	Calibrate Float Type Level Switch	2

7. SUGGESTED LIST OF PROPOSED STUDENT ACTIVITIES

7.1 Students may be asked to collect photographs using internet which is relevant to field application of various topics & have to prepare learning materials using it.

7.2 Teachers guided self learning activities, industrial visit, Course/library/internet/lab based mini projects etc.

7.3 Students activities like: course/ topic based seminars, weeklong implant training, Internet based assignments.

8. SUGGESTED LEARNING RESOURCES

A. Installation Manuals List (Books)

Sr. No.	Instrument Manufacturer /Author	Title of Manual / Books	Instrument Manufacturer Publication
1	B.G. Liptak	Instrument Engineers' Handbook, Fourth Edition, Volume One and Two:	CRC press
2	W.G.Andrew/H. B.Williams	Applied Instrumentation in the Process Industries- Vol 1 to 3	Gulf Publishing Company
3	Yokogava	Installation Manual LAN- STAR Topology , LAN- BUS Topology	www.yokogawa.com
4	Rockwell Automation	Installation Manual for Thermocouple , RTD ,	www.rockwellautomation.com
5	Fischer Rose Mount	Installation Manual for Pressure ,Level ,Flow ,Temperature measuring instruments /Switches	www.fisher.com
6	JNMARSHALL Product Groups Forbes Marshall	Installation Manual for Pressure ,Level ,Flow , Temperature measuring instruments /Switches, Temperature measuring instruments /Switches , Orifice ,Thermocouple with Well	http://www.forbesmarshall.com/fm_micro/productGroups.aspx?id=JNMARSHALL
7	Bestobell	Installation Manual for Pressure ,Level ,Flow ,,Temperature measuring instruments Filled System Thermometer , Thermocouple with Well /Switches	http://www.bestobell.com/concrete5.5.2.1

B. List of Major Equipment/ Instrument as mentioned in curriculum

8.1 Thermocouple,RTD,Bimetallic thermometer

8.2 Flowmeters, Scanner ,Web Camera etc.

C. List of Software/Learning Websites

1. Windows operating System
2. MS Office
3. Process Instrumentation Simulation software
4. http://en.wikipedia.org/wiki/Instrumentation

5. http://en.wikipedia.org/wiki/Resistance_thermometer#Wiring_configurations

9. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnic

1. **Prof.N.B.Mehta**, LECTURER IC ENGG., Government Polytechnic, Ahmedabad
2. **Prof.S.K.Raval**, Lecturer IC ENGG., Government Polytechnic, Ahmedabad
3. **Prof.M.B. Vanara**, Lecturer IC ENGG., Government Polytechnic, Ahmedabad
4. **Prof.Naved J. Dehlvi**, Lecturer IC ENGG., Government Polytechnic, Gandhinagar.

Co-ordinator and Faculty Member from NITTTR Bhopal

1. **Dr. Joshua Earnest,** Professor and Head, Dept. of Electrical & Electronics Engg.
2. **Prof. A.S.Walkey**, Associate Professor, Dept. of Electrical & Electronics Engg.