

Course Name : Electronics Engineering Group
Course Code : EJ/EX/ET/EN/IE
Semester : Fourth
Subject Title : Industrial Measurements
Subject Code : 174

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
03	--	02	03	100	--	--	25@	125

NOTE:

- Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.
- Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work. (SW)

Rationale:

The science of instrumentation system plays vital role in the development of technology. An electronic system has prime importance in the field of instrumentation. Most of the physical parameters can be converted into electrical signal with the use of transducers. The obtained electrical signal can be conditioned, processed, displayed and controlled with the use of advanced control system.

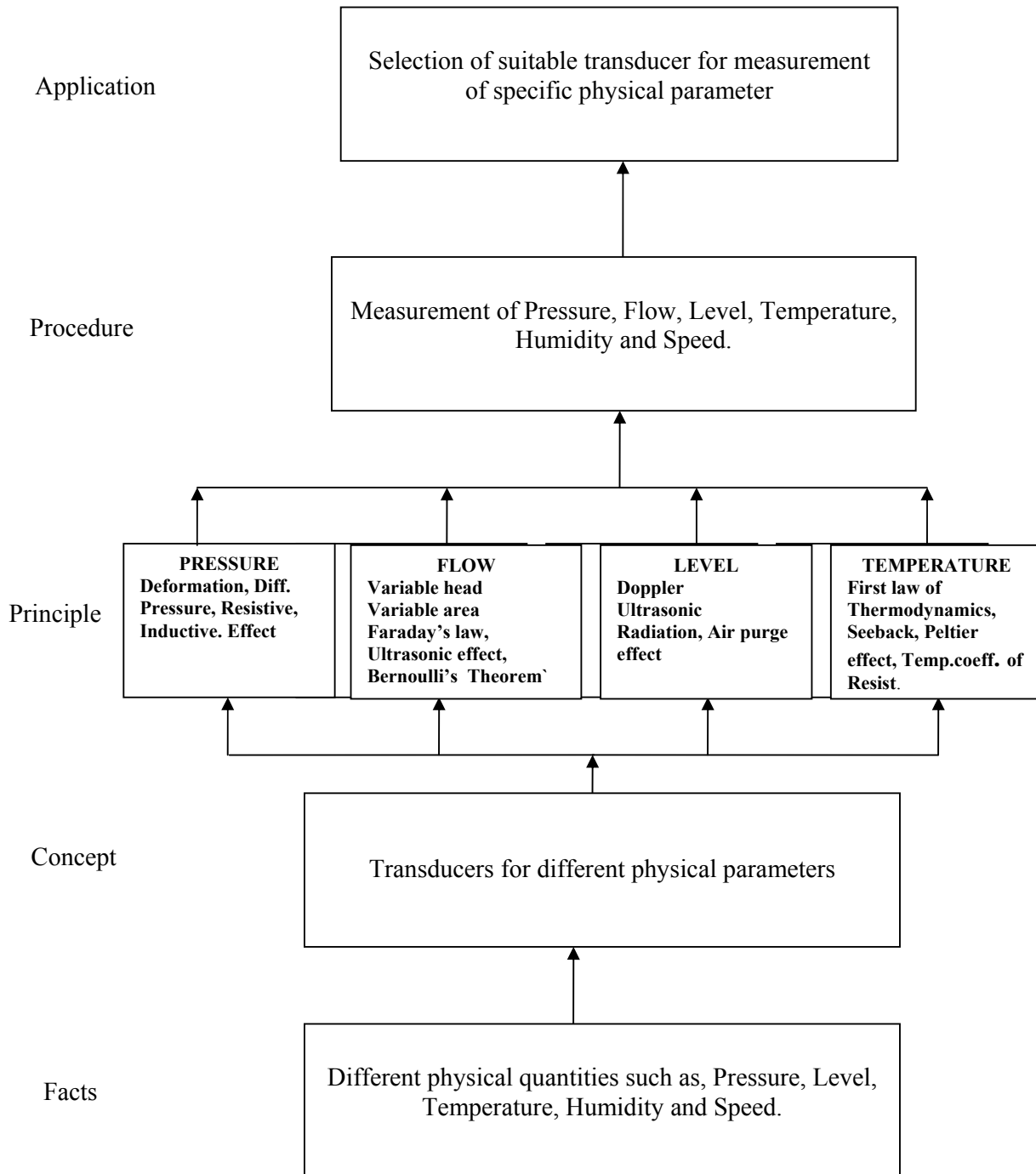
With the background of measuring instruments, this subject deals with measurement of different physical parameters like temperature, pressure etc. covering the entire gamut of industrial measurement. Different types of transducers used for measurement of different physical quantities with their construction, working principle, advantages, and disadvantages are studied through this subject.

General Objectives:

After studying this subject the students will be able to:

- 1) Understand the nature and working of instrumentation system used in industrial & general applications.
- 2) Classify the physical parameters with their proper units
- 3) Understand the concepts of different types of transducers

Learning Structure:



Theory Contents:

Topic No	Theory	Hrs.	Marks
1	<p>Transducers: Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Draw and describe the block diagram of Instrumentation system. ➤ Compare different Transducers ➤ Draw and describe different Electronic Transducers. <p>Contents</p> <ul style="list-style-type: none"> • Instrumentation System: Block diagram of Instrumentation system: Function of each block, Explanation of basic instrumentation systems • Transducer: Need of Transducer: Classification of transducers: Active and Passive, Analog and Digital, Primary and Secondary. • Electrical Transducers: Resistive transducers- Linear & Angular potentiometers Capacitive transducer Inductive transducer –LVDT, RVDT (As a displacement transducer) Piezoelectric transducer (Principle of operation and applications of above) • Selection criterion of transducers 	08	16
2	<p>Pressure measurement</p> <ul style="list-style-type: none"> ➤ Draw and describe the non-elastic and elastic pressure transducers. ➤ Draw and describe electronic pressure transducers. ➤ Write procedure of calibration of elastic pressure gauges using dead weight tester. <p>Contents</p> <ul style="list-style-type: none"> • Pressure: Definition Types - Absolute, Gauge, Atmospheric, Vacuum(Definition, Units) • Classification of Pressure measuring devices • Non elastic pressure transducer: U tube Inclined Tube Well type manometer • Elastic pressure transducer: Bourdon Tube Bellows Diaphragm Capsule • Electronic pressure transducers: Bourdon tube with LVDT Diaphragm with Strain gauge 	08	20

	<ul style="list-style-type: none"> • Calibration of pressure gauge using dead weight tester <p>Note: Each transducer should be studied on the basis of working principle, construction, advantages, disadvantages and applications.</p>		
3	<p>Flow Measurement</p> <ul style="list-style-type: none"> ➤ List of different types of flow. ➤ List of different types of flow measuring transducers. ➤ Draw and describe construction and working of different Flow measuring transducers. <p>Contents</p> <ul style="list-style-type: none"> • Flow: <ul style="list-style-type: none"> Definition Types of Flow –Laminar, turbulent , Reynolds number • Classification of flow measuring transducers : <ul style="list-style-type: none"> Variable head flow meter- Venturimeter, orifice plate meter Variable area flow meter – Rota meter Electromagnetic Flow meter Ultrasonic flow meter- Time difference and Doppler Type <p>Note: Each transducer should be studied on the basis of working principle, construction, advantages, disadvantages and applications.</p>	06	14
4	<p>Level Measurement</p> <ul style="list-style-type: none"> ➤ State the need of level measurement. ➤ List of different level measuring methods. ➤ Draw the construction and describe working of Level measuring transducers. <p>Contents</p> <ul style="list-style-type: none"> • Level: <ul style="list-style-type: none"> Definition Need of level measurement • Classification of level measurement methods: <ul style="list-style-type: none"> Float type – linear & rotary potentiometer (Contact type) Capacitive type (Contact type) Ultrasonic type (Non-contact type) Radiation type (Non-contact type) RADAR type (Non-contact type) <p>Note: Each transducer should be studied on the basis of working principle, construction, advantages, disadvantages and applications.</p>	08	16
5	<p>Temperature measurement</p> <ul style="list-style-type: none"> ➤ List different temperature measuring scales and its conversions. ➤ List different temperature measuring transducers. ➤ Draw the construction and describe working of different temperature transducers. <p>Contents</p> <ul style="list-style-type: none"> • Temperature : <ul style="list-style-type: none"> Definition and units First law of thermodynamics Different temperature scales & their conversions • Classification of temperature measuring transducers: 	10	20

	<p>Filled system type thermometer. Bimetallic thermometer Thermistors RTD – (PT-100) , 2 /3/4 wire systems (circuit diagram only) Thermocouple – Seeback & Peltier effect , Types J, K, R , S, T etc. (Based on material, temperature ranges) Pyrometer - Optical, Radiation</p> <p>Note: Each transducer should be studied on the basis of working principle, construction, advantages, disadvantages and applications.</p>		
6	<p>Special Transducers and Measurements</p> <ul style="list-style-type: none"> ➤ List different types of humidity and its units. ➤ Draw the construction and describe working of Humidity transducers. ➤ Draw the construction and describe working of Speed measuring transducers. <p>Contents</p> <ul style="list-style-type: none"> • Humidity: Definition Types - Absolute, relative • Humidity measurement devices: Psychrometer - Dry & wet Bulb thermometer type Hygrometer- hair type , capacitive , resistive type • Speed Definition Classification of speed measurement methods Photoelectric pick-up (Non contact type) Magnetic pick-up (Non contact type) • pH Measurement <p>Note: Each transducer should be studied on the basis of working principle, construction, advantages, disadvantages and applications.</p>	08	14
	Total	48	100

Practical:**Skills to be developed:****Intellectual Skills:**

- Selection of transducer based on application.
- Interpretation of results.

Motor Skills:

- Connection of different transducers with measuring system.
- Measurement of various physical parameters using transducers.
- Observation and plotting the characteristics.

List of Practicals:

- 1) Weight measurement using Strain Gauge with Cantilever Set-up.
- 2) Pressure measurement using Bourdon Tube type Pressure gauge.
- 3) Calibration of Pressure gauge using Dead Weight Pressure gauge Tester.
- 4) Flow measurement using Rota meter.

- 5) Flow measurement using Orifice meter/ Venturi meter.
- 6) Temperature measurement using RTD (Pt-100).
- 7) Temperature measurement using Thermocouple (using any one from R, J, K etc.)
- 8) Speed measurement by Photo-electric/ Inductive effect.
- 9) Displacement measurement using LVDT.
- 10) Level measurement using Capacitive / Float type transducer.
- 11) Measurement of Humidity (using any one hygrometer)

Learning Resources:

1. Books:

Sr. No.	Author	Title	Publisher
01	A.K.Sawhney	Electrical and Electronic Measurements and Instrumentation	Dhanpat Rai & Sons.
02	S.K.Singh	Industrial Instrumentation & Control	Tata McGraw Hill Publishing Co. Ltd; N. Delhi
03	D. Patranabis	Principles of Industrial Instrumentation	Tata McGraw Hill Publishing Co. Ltd; N. Delhi
04	Rangan Mani Sharma	Instrumentation Systems and Devices	Tata McGraw Hill Publishing Co. Ltd; N. Delhi
05	Bela Liptak Kriszta Venczel	Process Measurement Instrument Engineers Handbook	Chilton Book Co.
06	B.C.Nakra K.K.Chaudhry	Instrumentation Measurement and Analysis	Tata McGraw Hill Publishing Co. Ltd; N. Delhi.

2. CD/ PPTs etc.:

- www.proprofs.com/webschool
- www.osvn.com

3. Websites

- <http://en.wikipedia.org/wiki/>
- www.youtube.com/ “here type name of instrument”
- www.controlnet.com