

DEPARTMENT OF INSTRUMENTATION AND CONTROL ENGINEERING

COURSE PLAN – PART I			
Name of the Programme and specialization	M. Tech , Industrial Automation		
Course Title	Measurement in Manufacturing and Process Industries		
Course Code	IC 601	No. of Credits	3
Course Code of Pre-requisite subject(s)	Nil		
Session	July 2020	Section	NA
Name of Faculty	Dr. M. Umapathy	Department	ICE
Official Email	umapathy@nitt.edu	Telephone No.	0431-2503353
Name of Course Coordinator(s)	NA		
Official E-mail	umapathy@nitt.edu	Telephone No.	9443013136
Course Type (please tick appropriately)	Program Core course		
Syllabus (approved in BoS)			
<p>Course Content</p> <p>Introduction - Definition of Instrumentation, Static characteristics, Dynamic Characteristics, Types of errors and statistical analysis of errors, Calibration and Standards. Transducers - Resistance, capacitance, inductance type, piezoelectric, photoelectric. Displacement, velocity and acceleration measurements. Force, Load and Torque Measurement.</p> <p>Temperature measurement - Introduction to temperature measurements, Thermocouple, Resistance Temperature Detector, Thermistor and its measuring circuits, Radiation pyrometers and thermal imaging.</p> <p>Pressure measurement - Introduction, definition and units, Mechanical, Electro-mechanical and electronic pressure measuring instruments. Low pressure measurement.</p> <p>Pressure and temperature transmitters, Current to pneumatic and pneumatic to current converters.</p>			

Flow measurement - Introduction, definition and units, classification of flow meters, differential pressure and variable area flow meters, Positive displacement flow meters, Electro Magnetic flow meters. Hot wire anemometer, laser Doppler anemometer, ultrasonic, vortex and cross correlation flow meters, and measurement of mass flow rate.

Level measurement - Introduction, Differential pressure level detectors, Capacitance level sensor, Ultrasonic level detectors and Radar level transmitters and gauges. Design of transmitters, self-diagnostics, communication, and remote calibration.

Safety - Introduction, electrical hazards, hazardous areas and classification, non-hazardous areas, enclosures - National Electrical Manufacturers Association (NEMA) types, fuses and circuit breakers. Protection methods: Purging, explosion proofing and intrinsic safety. Study for choice of materials in application areas - with respect to temperature, pressure, and corrosion environments (interface) and fluid interface.

Text Books

1. Ernest. O. Doebelin and Dhanesh.N.Manik, "*Measurement Systems*, McGraw Hill Education, 6th Edition, 2011.
2. Thomas G. Beckwith, Roy D. Marangoni, Lienhard, "*Mechanical Measurements*", Pearson Education India, 6th Edition, 2013.
3. Patranabis D, "*Principles of Industrial Instrumentation*", Tata McGraw Hill, 3rd Edition, 2010.

Reference Books

1. B.G.Liptak, "*Process Measurement and Analysis*", CRC Press, 4th Edition, 2003.
2. B.E.Noltingk, "*Instrumentation Reference Book*", Butterworth Heinemann, 2nd Edition, 1995.
3. Douglas M. Considine, "*Process / Industrial Instruments & Controls Handbook*", McGraw Hill, Singapore, 5th Edition, 1999.
4. Andrew W.G, "*Applied Instrumentation in Process Industries – A survey*", Vol I & Vol II, Gulf Publishing Company, Houston, 2001
5. Spitzer D. W., "*Industrial Flow measurement*", ISA press, 3rd Edition, 2005.
6. Tony. R. Kuphaldt, "*Lessons in Industrial Instrumentation*", Version 2.02, April 2014.
7. Lawrence D. Goettsche, "*Maintenance of Instruments and Systems*", International Society of Automation, 2nd Edition, 2005.
8. Norman A. Anderson, "*Instrumentation for Process Measurement and Control*", CRC Group, Taylor and Francis Group, 3rd Edition, 2010.
9. James W. Dally, William F. Riley, Kenneth G. McConnell "*Instrumentation for Engineering Measurements*", Wiley India Private Limited, 2nd Edition, 2010.

COURSE OBJECTIVES

1. To expose the students to the importance of measurements in manufacturing and process industries.
2. To expose the students to various measurement techniques used for the measurement of physical variables in manufacturing industries
3. To expose the students to various measurement techniques used for the measurement of physical variables in process industries
4. To make the students knowledgeable in the design, installation and troubleshooting of the instruments used in manufacturing and process instruments.

MAPPING OF COs with POs

Course Outcomes	Programme Outcomes (PO) (Enter Numbers only)
On completion of the course, the student will be able to,	
1. study the characteristics and specification of instruments	1, 2
2. Understand the sensors and transducers used in manufacturing industries like displacement, velocity, acceleration, force, torque and load.	1, 3
3 Gain knowledge of different temperature, pressure, flow and level measurement techniques used in process industries	1, 2, 3
4. Grasp the world class industrial safety aspects	1, 3

COURSE PLAN – PART II**COURSE OVERVIEW**

The course introduces basic principle of various sensors used in manufacturing and process industries. Also aims to expose the various safety designs involved in sensors.

COURSE TEACHING AND LEARNING ACTIVITIES

S.No.	Week/Contact Hours	Topic	Mode of Delivery
1	16.9.2020-20.10.2020	Introduction - Definition of Instrumentation, Static characteristics, Dynamic Characteristics, Types of errors and statistical analysis of errors, Calibration and Standards. Transducers - Resistance, capacitance, inductance type, piezoelectric, photoelectric. Displacement, velocity and acceleration measurements. Force, Load and Torque Measurement.	Online session Discussion and presentation by students
2	21.10.2020-29.11.2020	Temperature measurement Introduction to temperature measurements, Thermocouple, Resistance Temperature Detector, Thermistor and its measuring circuits, Radiation pyrometers and thermal imaging.	Online session Discussion and presentation by students
3	02.11.2020-10.11.2020	Pressure measurement - Introduction, definition and units, Mechanical, Electro-mechanical and electronic pressure measuring instruments. Low pressure measurement. Pressure and temperature transmitters, Current to pneumatic and pneumatic to current converters.	Online session Discussion and presentation by students
4	11.11.2020-19.12.2020	Flow measurement - Introduction, definition and units, classification of flow meters, differential pressure and variable area flow meters, Positive displacement flow meters, Electro Magnetic flow meters. Hot wire anemometer, laser Doppler anemometer, ultrasonic, vortex and cross correlation flow meters, and measurement of mass flow rate.	. Online session Discussion and presentation by students Invited talk by Industrial experts

5	20.11.2020- 24.11.2020	Level measurement - Introduction, Differential pressure level detectors, Capacitance level sensor, Ultrasonic level detectors and Radar level transmitters and gauges. Design of transmitters, self-diagnostics, communication, and remote calibration.	Online session Discussion and presentation by students
6	25.11.2020- 9.12.2020	Safety - Introduction, electrical hazards, hazardous areas and classification, non-hazardous areas, enclosures - National Electrical Manufacturers Association (NEMA) types, fuses and circuit breakers. Protection methods: Purging, explosion proofing and intrinsic safety. Study for choice of materials in application areas - with respect to temperature, pressure, and corrosion environments (interface) and fluid interface.	Online session Discussion and presentation by students Invited talk by Industrial experts

COURSE ASSESSMENT METHODS (shall range from 4 to 6)

S. No	Mode of Assessment	Week/Date	Duration	% Weightage
1.	Assessment I(online)	3 rd week of Oct 2020	1hour	20%
2	Assessment II(online)	3 rd week of Nov 2020	1hour	20%
3	Assessment III Assignment, Presentation (online)	Continuous Throughout the semester	NA	30%
	Compensation Assessment* (online)	Week before final Assessment	1 hour	20%
4	Final Assessment *(Online)	4 th week of Dec 2020	2 hours	30%

***mandatory; refer to guidelines on page 4**

COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)

Feedback from students will be obtained during the course Students' performance in test and their presentation during discussion will be used to assess the understanding level.

COURSE POLICY (including compensation assessment to be specified)

1. 75% of attendance is must, inclusive of On duty on any grounds. 5% of relaxation can be considered on medical grounds. Students not acquiring the required attendance will be assigned V grade.

2. Relative grading with passing minimum of 40 % or clustering will be followed, on seeing the overall performance of the students and if the class strength is less than 10 absolute grading policy will be followed.

3. For the students missing the assessment for medical reasons, one compensation assessment will be conducted one week before the final assessment for a weightage, equal to that of the missed assessments. But students are advised not to miss the assessments.

4 For the students not passing the course, reassessment will be conducted during the first week of next semester for a weightage of 100% and the grades will be given on absolute grading policy.

6. For academic dishonesty institute policy will be followed. As assessments are happening online students are advised not to practice copying, plagiarism check will be happening.

ADDITIONAL INFORMATION, IF ANY

NIL

FOR APPROVAL

Course Faculty  CC- Chairperson  HOD 