**20EC31E1- ELECTRONIC MEASUREMENT & TECHNIQUES**

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|  **Course category:** | Program core | **Credits:** | 3 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** |  3-0 - 0 |
| **Prerequisite:** | Electronic Devices and Circuits, Pulse and Analog Circuits, Signals & Systems  | **Sessional Evaluation :****External Evaluation:****Total Marks:** | 4060100 |
| **Course****Objectives** | Students undergoing this course are expected to understand: |
| 1. The various standards and units of measurements, electronic instruments, their construction, applications, and principles of operation.
2. The internal structure of analog and digital instruments that are used in measuring parameters and also difference between analog meters and digital meters and their performance characteristics.
3. The importance of different waveforms and their generation.
4. The functioning of CRO including digital oscilloscope and its operation.
5. The measurement using bridges for resistances, inductance and capacitances.
6. Different type of sensors and transducers and their application.
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| **Course Outcomes** | Upon successful completion of the course , the students will be able to: |
| **CO1** | Explain various performance characteristics of instruments like accuracy, sensitivity, resolution and speed of response and their importance in meters. |
| **CO2** | Design basic meters with good performance characteristics. |
| **CO3** | Generate various signals using signal generators and harmonic distortion analyzer with the help of oscilloscope. |
| **CO4** | Analyse the waveforms and signals with the help of oscilloscopes. |
| **CO5** | Understand precision measurement techniques to measure resistance, capacitance using different transducers. |
| **CO6** | Identify the transducers for various applications like to measurement of force, voltage, and speed with the help of bridges. |
| **Course****Content****Course****Content** | **UNIT-I****SCIENCE OF MEASUREMENTS**:Measurement System, Instrumentation, Characteristics of measurement systems – Static and Dynamic, Errors in Measurements, Calibration and Standards. **UNIT-II****METERS:** D.C. Voltmeters- D.C. Ammeters Multi range, Range extension, A.C. voltmeters- multi range, Ohmmeters - series type, shunt type, Multimeter.**UNIT-III****FIXED AND VARIABLE SIGNAL GENERATORS**: AF oscillators, Standard and AF sine and square wave signal generators, Function Generators, Random noise, sweep, Arbitrary waveform generators, Wave Analyzers, Harmonic Distortion Analyzers, Spectrum Analyzer.**UNIT-IV****OSCILLOSCOPES**: C.R.T. features, vertical amplifiers, horizontal deflection system, sweep circuit, delay line, sync selector circuits, triggered sweep C.R.O., Dual beam and Dual Trace Oscilloscopes, Digital Storage Oscilloscope, Measurements – Lissajous method of frequency measurement.**UNIT-V****COMPARATIVE METHODS OF MEASUREMENTS:** D.C potentiometers, D.C bridges (Wheat stone, Kelvin and Kelvin Double bridge) & A.C bridges (Maxwell, Anderson and Schering bridges), Q-meter.**UNIT-VI****TRANSDUCERS AND DATA ACQUISITION SYSTEMS:** Classification of transducers, Selection of transducers, Resistive, capacitive & inductive Transducers, Piezoelectric, Hall effect, optical and digital transducers, Elements of data acquisition system – Introduction to Smart sensors. |
| **Text Books and Reference Books** | **TEXT BOOKS:**1. Modern Electronic Instrumentation and Measurement Techniques – A. D. Helfrick and W. D. Cooper, Pearson, 1st Edition, 2015.
2. Electronic instrumentation, 3rd edition - H. S. Kalsi, Tata McGraw Hill, 2017.
3. Ernest O Doebelin and Dhanesh N Manik, "Measurement Systems", McGraw-Hill, 6th Edition, 2017.

**REFERENCE BOOKS:** 1. Electronic Instrumentation & Measurements - David A. Bell, P.H.I., 2nd Edition, 2003.
2. Principles of Industrial Instrumentation-Patranabis D.McGraw Hill US, 3rd Edition.
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| **E-Resources** | 1. http://www.nptel.ac.in.
2. http:/www.ebookee.com/electronicmeasurementand instrumentation.
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| **Contribution of Course Outcomes towards achievement of Program Outcomes** |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | 2 | 3 | 3 |
| CO2 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | - | 1 | - | - | 2 | 3 | 2 |
| CO3 | 3 | 3 | 3 | 2 | 2 | 2 | - | - | 1 | - | - | 2 | 2 | 3 |
| CO4 | 3 | 3 | 2 | 2 | 1 | 2 | - | 1 | 2 | 2 | - | 2 | 2 | 3 |
| CO5 | 3 | 3 | 2 | 2 | 1 | 2 | - | 1 | - | - | - | 2 | 3 | 2 |
| CO6 | 3 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | 2 | 3 | 2 |