**19EC31E1 – ELECTRONIC MEASUREMENTS & INSTRUMENTATION**

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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 tounderstand: |
| 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 digital oscilloscope. |
| **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****PERFORMANCE CHARACTERISTICS OF INSTRUMENTS**:Static characteristics, Accuracy, Resolution, Precision, Expected value, Error, Sensitivity. Errors in Measurement, Dynamic Characteristics-speed of response, Fidelity, Lag and Dynamic error, Problems in error calculation. **UNIT-II****METERS:** D.C. Voltmeters- D.C. Ammeters Multi range, Range extension, A.C. voltmeters- multi range, range extension, Ohmmeters - series type, shunt type, Multimeter for Voltage, Current and resistance measurements.**UNIT-III****FIXED AND VARIABLE SIGNAL GENERATORS**: AF oscillators, Standard and AF sine and square wave signal generators, Function Generators, Square pulse, Random noise, sweep, Arbitrary waveform. Wave Analyzers, Harmonic Distortion Analyzers, Spectrum Analyzer.**UNIT-IV****OSCILLOSCOPES**: C.R.T. features, vertical amplifiers, horizontal deflection system, sweep, trigger pulse, delay line, sync selector circuits, triggered sweep C.R.O., Dual beam C.R.O., Measurement of Amplitude and Frequency, Dual Trace Oscilloscope, Sampling Oscilloscope, Digital Readout Oscilloscope, Digital Storage Oscilloscope, Lissajous method of frequency measurement.**UNIT-V****BRIDGE MEASUREMENT:**Wheatstone bridge, Kelvin Bridge, Measurement of Resistance, A.C. Bridges, Measurement of inductance- Maxwell’s bridge, and Measurement of capacitance - Schering Bridge. Errors and precautions in using bridges, Q-meter.**UNIT-VI****TRANSDUCERS:** Active & Passive transducers : Resistance, Capacitance, Inductance; Strain gauges, L.V.D.T., Piezo Electric transducers, Resistance Thermometers, Thermocouples, Thermistors, Sensistors. Measurement of physical parameters force, Pressure, Velocity, Humidity, Moisture, Speed, Proximity and Displacement, Industrial Applications, Data acquisition systems. |
| **Text Books and Reference Books** | **TEXT BOOKS:**1. Modern Electronic Instrumentation and Measurement Techniques – A. D. Helfrick and W. D. Cooper, P.H.I., 5th Edition, 2002.
2. Electronic instrumentation, second edition - H. S. Kalsi, Tata McGraw Hill, 2004

**REFERENCE BOOKS:** 1. Electronic Instrumentation & Measurements - David A. Bell, P.H.I., 2nd Edition, 2003.
2. Principles of Industrial Instrumentation-PatranabisD.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 |