**20EE3201-ELECTRICAL & ELECTRONIC MEASUREMENTS**

**(EEE)**

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| **Course Category:** | Professional core | **Credits:** | 3 |
| **Course Type:** | Theory | **Lecture-Tutorial-Practical:** | 3-0-0 |
| **Pre-requisite:** | Basic electrical sciences, principle's of energy conversion, EDC | **Sessional Evaluation:****External Exam Evaluation:****Total Marks:** | 4060100 |

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| **Course Objectives:** | Students undergoing this course are expected to learn : |
| 1. The various potentiometers and bridges (both DC & AC).
2. The working principle of indicating instruments and integrating instruments.
3. About the instrument transformers and power factor meters.
4. The working of different types of oscilloscopes
5. The working of digital voltmeters, multimeter, tachometer and phase meter.
6. About the various transducers and the data acquisition systems
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| **Course Outcomes:** | After completing the course the student will be able to |
| CO1 | Understand the basics of measurements and working of PMMC & moving iron meters. |
| CO2 | Empathize various types of indicating instruments and integrating instruments, requirement of calibrations and instruments with errors in measurement etc. |
| CO3 | Understand the working of DC and AC potentiometers and the working principle of instrument transformers. |
| CO4 | Understand the working of CRO, the different types of oscilloscopes and ability to measure voltage, current, frequency and phase with Oscilloscope. |
| CO5 | Discriminate different bridges used for measurement of resistance, capacitance and inductance. |
| CO6 | Understand about different transducers and their working principles. |
| **Course Content:** | **UNIT-I****Introduction to Measuring Instruments**: Classification – deflecting, control and damping torques .PMMC, moving iron type instruments – expression for the deflecting torque and control torque – Errors and compensations, extension of range using shunts and series resistance. **UNIT-II****Measurement of Power & Energy**: Single phase dynamometer wattmeter, LPF and UPF, Double element wattmeter, expression for deflecting and control torques – Extension of range of wattmeter using instrument transformers.**Power Factor meters:** Type of P.F. Meters – dynamometer and moving iron type **Single phase induction type energy meter** – driving and braking torques – errors and compensations – testing by phantom loading .**UNIT-III****Potentiometers & Instrument transformers:** Principle and operation of D.C. Crompton’s potentiometer – standardization – Measurement of unknown resistance, current, voltage. A.C. Potentiometers: polar and coordinate type’s standardization – applications. **CT and PT** – Ratio and phase angle errors **UNIT-IV****Cathode Ray Oscilloscope:** Block diagram of CRO, CRT, Electrostatic focusing, Electrostatic deflection sensitivity, Time Base generators, Oscilloscope amplifiers– Basic CRO Circuits, Observation of waveform on CRO, Principle of operation of Dual beam, Dual trace, Sampling and Storage CROs – Measurements with CRO (voltage, current, frequency, phase angle, Lissajous figures).**UNIT-V****DC & AC bridges**: Method of measuring low, medium and high resistance – sensitivity of Wheat-stone’s bridge, Kelvin’s double bridge for measuring low resistance. **Measurement of inductance**- Maxwell’s bridge, Hay’s bridge, Anderson’s bridge. **Measurement of** **capacitance** –Desaunty’s Bridge - Wien’s bridge – Schering Bridge. **Digital instruments:** Digital voltmeters-Ramp- Dual slope- stair case- successive approximation types- Digital multimeter - Digital tachometer- Digital phase meter- LCR meter.**UNIT-VI****Transducers:** Definition of transducers, Classification of transducers, Advantages of Electrical transducers, Characteristics and choice of transducers; Principle operation of LVDT and capacitor transducers, LVDT Applications, Strain gauge and its principle of operation, gauge factor, Thermistors, Thermocouples, Piezo electric transducers. |
| **Text Books & Reference Books:** | **TEXT BOOKS:**1. “Electrical and Electronics Measurements and Instrumentation”, Prithwiraj Purkait, Tata McGraw Hill, 2013.
2. “Electrical & Electronic Measurements and Instrumentation”, A.K. Sawhney, Dhanpath Rai& Co (P) Ltd, 2004.
3. Electrical Measurements and measuring Instruments – by E.W. Golding and F.C. Widdis, 5th Edition Reem publication,2011.

**REFERENCE BOOKS:**1. “Electrical Measurements and Measuring Instruments”, [Rajendra Prasad](https://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22Rajendra+Prasad%22), Khanna publications,1984.
2. “Electrical and Electronics Measurements”, R.K.Rajput, S.Chand publications.
3. Electrical Measurements: Fundamentals, Concepts, Applications – by

Reissland, M.U, New Age International (P)Limited,2010. |
| **e-Resources:** | http://nptel.ac.in/courseshttp://iete-elan.ac.inhttp://freevideolectures.com/university/iitm |