SCHEME OF COURSE WORK

Course Details:

Course Title	**: Electrical Measurements and Instrumentation**		
Course Code	**:13EE1114**	**L T P C**	**:4 0 0 3**
Program:	**: B.Tech.**		
Semester	**: V**		
Prerequisites	**: Knowledge of Basic Network Analysis**		
Courses to which it is a prerequisite	**: - All courses in B.Tech Syllabus except Humanities**		

Course Outcomes (COs):

1	Summarize basic principles of electrical measuring instruments explain their classification and categorize the types of errors.
2	Describe the construction and principle of operation of instruments for measurement of Power, energy, power- factor and power frequency.
3	Explain the principle and operation of DC Cromptons potentiometer and bridge methods for measurement of Resistance, Inductance and Capacitance.
4	Describe the methods for measurement of magnetic, optical and thermal quantities.
5	State the classification of Transducers and understand the characteristics and applications of electrical transducers.

Program Outcomes (POs):

The student of Electrical and Electronics Engineering at the end of the program will be able to:

PO-1	Apply the knowledge of basic sciences and electrical and electronics engineering fundamentals to solve the problems of power systems and drives.
PO-2	Analyze power systems that efficiently generate, transmit and distribute electrical power in the context of present Information and Communications Technology.
PO-3	Design and develop electrical machines and associated controls with due considerations to societal and environmental issues.
PO-4	Design and conduct experiments, analyze and interpret experimental data for performance analysis.
PO-5	Apply appropriate simulation tools for modeling and evaluation of electrical systems.
PO-6	Apply the electrical engineering knowledge to assess the health and safety issues and their consequences.
PO-7	Demonstrate electrical engineering principles for creating solutions for sustainable development.
PO-8	Develop a techno ethical personality that help to serve the people in general and Electrical and Electronics Engineering in particular.
PO-9	Develop leadership skills and work effectively in a team to achieve project objectives.
PO-10	Communicate effectively in both verbal and written form.
PO-11	Understand the principles of management and finance to manage project in multi disciplinary environments.
PO-12	Pursue life-long learning as a means of enhancing the knowledge and skills.

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Course Outcome Versus Program Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	S	M	S	S	M	S	S	S		M	M	S
CO-2	S	S	S	S	S	S	S	S		M		S
CO-3	S	S	S	M	M	S	S	M	M		S	S
CO-4	S	M	S	S	M	S	S	M	M	M	M	S
CO-4	S	M	S	M	M	M	S	S	M			S

S - Strongly correlated, *M* - *Moderately* correlated, *Blank* - *No correlation*

Assessment Methods:	Assignment / Quiz / Seminar / Case Study / Mid-Test / End Exam

Teaching-Learning and Evaluation

Week	TOPIC / CONTENTS	Course Outcomes	**Sample questions**	TEACHING-LEARNING STRATEGY	Assessment Method & Schedule
1	Measuring systems, Performance Characteristics, Static Characteristics, Dynamic Characteristics. Errors in Measurements – Gross errors, systematic Errors, Statistical analysis of Random Errors.	C0-1	1. What are the dynamic characteristics of measuring instruments? 2. Explain the classification of characteristics of measuring instruments 3. Explain the statistical analysis of Random Errors. 4. Classify the errors in measurement. Give an example for each. Discuss the means adopted to reduce this errors.	Lecture/Discussion	Assignment-1 Aug-15
2	Classification – Deflecting, Control and Damping Torques – Ammeters and Voltmeters – PMMC & MI Type Instruments – Expression for the Deflecting Torque and Control torque	C0-1	1. What are different types of torques. Explain the difference the difference between spring control and gravity control. 2. Explain the construction and working of a PMMC instrument.	Lecture/Discussion	Assignment-1 Aug-15
3	Errors and Compensations, Extension of Range using Shunts and Series Resistance. Electrostatic Voltmeters, Electrometer and Attracted disc Types.	CO-1	1. What are different types of errors and how are they compensated. 2. Explain how an ammeter range can be extended. 3. What is swamping resistance. Explain the working of a electrostatic voltmeter.	Lecture/Discussion	Assignment-1 Aug-15
4	Single Phase and Three Phase Dynamometer wattmeter (LPF and UPF), Expression for Deflecting and Control Torques – Measurement of Active and Reactive Powers in Balanced and	C0-2	1. Explain the working and construction of a electrodynamometer type wattmeter. 2. How is reactive	Lecture/Discussion	Assignment-1 Aug-15

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	Unbalanced systems.		power measured? Explain.		
5	Single Phase Induction Type Energy Meter – Driving and Braking torques – Three Phase Energy Meter – Maximum Demand Meter.	C0-2	1. Explain the working of an induction type energy meter with a neat diagram. 2. What is creeping? What are various adjustments done in an energy meter.	Lecture/Discussion	Assignment-1 Aug-15
6	Type of P.F. Meters – Dynamometer and Moving Iron Type – Single and Three Phase meters, Frequency meters – Resonance Type and Weston type – Synchroscopes.	C0-2	1. Explain the working of a frequency meter. 2. What is a synchroscope and how it is used. Explain.	Lecture/Discussion	Assignment-1 Aug-15
7	Principle and operation of D.C. Crompton's potentiometer – Standardization – Measurement of unknown Resistance, Current, Voltage – Sensitivity of Wheatstone's bridge, Kelvin's Double Bridge for measuring Low Resistance, Measurement of High Resistance – Loss of Charge method and Megger.	C0-3	1. What is standardization. Explain how resistance is standardized. 2. Explain the working of a Kevlin's double bridge. Write short notes on megger	Lecture/Discussion	Quiz-1 Aug-15
8	**Mid Exam-1**	-	-		
9	Measurement of Inductance, Quality Factor - Maxwell's, Hay's & Anderson's Bridges, Measurement of Capacitance and loss angle – De Sauty's, Wien's & Schering Bridges.	C0-3	1. Where is Anderson's bridge used. Explain with a neat diagram. 2. The four arms of a Maxwell's capacitance bridge at balance are: arm ab, an unknown inductance L1, having an inherent resistance R1 arm bc, a non-inductive resistance of 1000W. Drive the equation of balance for the bridge and determine the value of R1 and L1. Draw the phasor diagram of the bridge under balance conditions.	Lecture/Discussion	Quiz-1 Aug-15
10	Ballistic galvanometer, Calibration of Hibbert's Magnetic Standard Flux meter, Lloyd Fischer Square for measuring Iron loss. Testing of ring and bar specimens, determination for BH curve and Hysteresis loss using CRO, Determination of leakage factor.	C0-4	1. Explain what are lysajous patterns and the inferences made from the same. 2. How is leakage factor determined. Explain Derive an expression for equation of motion of a ballistic galvanometer.	Lecture/Discussion	Quiz-1 Aug-15
11	Illumination-Definitions, Laws of Illumination, standards of Illumination intensity-substandards of illumination intensity, measurement of luminous intensity.	C0-4	1. What are the laws of illumination. How is luminous intensity measured.	Lecture/Discussion	Assignment-2 OCT-15
12	General methods of measuring temperature-electrical Resistance pyrometers-laws of resistance variation	C0-4	1. Write short notes on the following a)Classification of transducers.	Lecture/Discussion	Assignment-2 OCT-15

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	with temperature-indicators and recorders-Thermo electric pyrometers-thermo electric emf's, radiation pyrometers.		b) Photo conductive cells		
13	Current Transformer and Potential Transformer – Ratio and Phase angle errors – Design Considerations.	C0-5	1.Explain the differences between CT and PT. 2. What are ratio and phase angle errors and how are they rectified. Derive an expression for actual ratio of potential transformer.	Lecture/Discussion	Assignment-2 OCT-15
14	Definition of transducers, Classification of transducers, Advantages of Electrical transducers, Characteristics and choice of transducers; Principle operation of Resistor, Inductor, LVDT and Capacitor Transducers;	C0-5	1. What is a transducer? How are they classified. 2.What are the characteristics and how transducers are choosen.	Lecture/Discussion	Quiz-2 OCT-15
15	LVDT Applications, Thermistors, Thermocouples, Piezoelectric Transducers, Photovoltaic, Photo conductive cells, measurements of non electrical quantities-Strain gauge and its principle of operation, gauge factor, torque and angular velocity.	C0-5	1.How is strain gauge measured and what is the principle of operation. 2.Explain how non-electrical quantities can be measured using electrical apparatus. 3. What is a pyrometer and what is it used for. 4. What are the general methods for measuring temperature.	Lecture/Discussion	Quiz-2 OCT-15
16	**Mid-2**	-	-	-	-
17	(No Class work)	-	-	-	-
18 & 19	**END EXAM**	-	-	-	-