EE 0301 - ELECTRICAL AND ELECTRONICS MEASUREMENTS AND INSTRUMENTATION (R)											
Course designed by	Department of Electrical and Electronics Engineering										
Student outcomes	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
	x	**x**									
Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts(E)			Professional Subjects(P)		
									x		
Broad area (for 'P'category)	Electrical Machines		Circuits and Systems			Electronics			Power System	Intelligent Systems	
			x			**x**					
Course Coordinator	Mrs. C.Anuradha										

DETAILED SESSION PLAN

MEASUREMENT OF R,L,C

Functional elements of an instrument – static and dynamic characteristics – Errors in measurement. Measurement of R, L, C – Wheatstone, Kelvin's double, Maxwell, Anderson and Schering bridges. Measurement of high resistance – Megger – loss of charge method.

Session No.	Topics to be covered	Text book	Chap.no & Page No.	Testing Methods	Instructional Objective	Program Outcome
1	Functional elements of an instrument	Sawhney AK, A course in Electrical and electronic Measurement and Instrumentation, Dhanpat Rai & sons, New Delhi, 2001	1 & 9-11		1.Analyze the measurements of circuit parameters.	a) an ability to apply knowledge of mathematics, science, and engineering b) an ability to design and conduct experiments, as well as to analyze and interpret data
2	Static and dynamic characteristics		2 & 24 - 42, 4 & 102-108			
3	Errors in measurements		3 & 60 – 74			
4,5	Measurement of Resistances, high resistance, Loss of charge method		14 & 516-557, 15&558-562.			
6,7	Measurement of inductances and capacitances		16 & 585-603			

MEASURING INSTRUMENTS

Principle of operation and construction of PMMC, MI, Dynamometer, Induction, Thermal and Rectifier type instruments – Measurement of voltage and current – use of ammeter shunts and voltmeter multiplier – Use of CT and PT for extending instrument ranges.

Session No.	Topics to be covered	Text book	Chap.no & Page No.	Testing Methods	Instructional Objective	Program Outcome
8,9	Principle of operation and construction of PMMC, MI	Sawhney AK, A course in Electrical and electronic Measurement and Instrumentation, Dhanpat Rai & sons, New Delhi, 2001	9 & 292-383		1.Analyze the measurements of circuit parameters. 2.Understand the operation and construction of various types of measuring instruments.	a) an ability to apply knowledge of mathematics, science, and engineering b) an ability to design and conduct experiments, as well as to analyze and interpret data
10	Principle of operation and construction of Dynamometer.		13 & 495-510			
11	Thermal type instruments		9 & 339-346			
12	Rectifier type instruments		9 & 359 – 372			
13,14	Measurement of voltage and current		9 & 292-308			
15, 16	Use of CT and PT for extending instrument ranges.		10 & 384-426			

MEASUREMENT OF POWER AND ENERGY

Dynamometer type wattmeter – induction type energymeter- 1 phase & 3 phase – errors and compensation – energymeter calibration by direct and phantom loading – Maximum demand indicator – Measurement of reactive power – Trivector meter.

Session No.	Topics to be covered	Text book	Chap.no & Page No.	Testing Methods	Instructional Objective	Program Outcome
17	Dynamometer type wattmeter	Sawhney AK, A course in Electrical and electronic Measurement and Instrumentation, Dhanpat Rai & sons, New Delhi, 2001	11 & 430-433		2.Understand the operation and construction of various types of measuring instruments. 3. Gain knowledge	a) an ability to apply knowledge of mathematics, science, and engineering
18,19	Induction type energymeter- 1phase& 3 phase		12 & 463-			

20	Errors and compensation		**11 & 433-439, 444**		on the measurement of power, energy.	b) an ability to design and conduct experiments, as well as to analyze and interpret data
21, 22	Energymeter calibration by direct and phantom loading		**12 & 483**			
23	Maximum demand indicator		**12 & 475**			
24	Measurement of reactive power		**11 & 456**			
25	Trivector meter.		**12 & 480**			

MEASUREMENT OF FREQUENCY,POWER FACTOR AND PHASE SEQUENCE

Frequency meters – Powerfactor meter - 1 phase & 3 phase – Synchroscope – Phase sequence indicator. Magnetic tape recorders – Stripchart recorder – X-Y recorder – Cathode ray Oscilloscope – block diagram – CRT – Dual Trace oscilloscope.

Session No.	**Topics to be covered**	**Text book**	**Chap.no & Page No.**	**Testing Methods**	**Instructional Objective**	**Program Outcome**
26, 27	Frequency meters	Sawhney AK, A course in Electrical and electronic Measurement and Instrumentation, Dhanpat Rai & sons, New Delhi, 2001	**12 & 500-507**		2.Understand the operation and construction of various types of measuring instruments. 3.Gain knowledge on the measurement of frequency, power factor and phase sequence.	a).An ability to apply knowledge of mathematics, science, and engineering. b). An ability to design and conduct experiments, as well as to analyze and interpret results.
28	Powerfactor meter - 1 phase & 3 phase		**12 & 495-500**			
29	Synchroscope		**12 & 507-511**			
30	Phase sequence indicator		**12 & 511-515**			
31	Magnetic tape recorders – Stripchart recorder – X-Y recorder		**28 & 1309-1320**			
32	Cathode ray Oscilloscope block diagram – CRT		**21 & 784-814**			
33	Dual Trace oscilloscope.		**21 & 815**			

ELECTRONIC INSTRUMENTS Electronic voltmeters – Digital voltmeter – Multimeter – Signal generator – Function generator. Classification of transducers – resistive, capacitive and inductive – piezoelectric transducer – strain gauges – LVDT – thermoelectric – piezoelectric. Transducers for measurement of displacement – temperature – pressure – velocity.						
Session No.	**Topics to be covered**	**Text book**	**Chap.no & Page No.**	**Testing Methods**	**Instructional Objective**	**Program Outcome**
34	Electronic voltmeters – Digital voltmeter – Multimeter	Sawhney AK, A course in Electrical and electronic Measurement and Instrumentation, Dhanpat Rai & sons, New Delhi, 2001	**20 & 740-762, 28& 13041309**		Understand the concept of various electronic instruments.	a).An ability to apply knowledge of mathematics, science, and engineering. b). An ability to design and conduct experiments, as well as to analyze and interpret results.
35	Signal generator, Function generator		**22 & 865-874**			
36, 37	Classification of transducers-resistive, strain gauges		**25 & 935-974**			
38	Thermoelectric		**25 & 979-998**			
39,40	Classification of transducers-inductors, LVDT.		**25 & 998-1014**			
41	Classification of transducers-capacitors		**25 & 1014 – 1028**			
42	Piezoelectric transducer		**2 5& 1028 – 1040**			
43	Transducers for measurement of displacement		**25 & 1042**			
44	Transducers for measurement of pressure		**29 & 1354-1367**			

45	Transducers for measurement of velocity.		**29 & 1367 -1372**			

TEXT BOOKS

1. Golding, EW. & Widdies, FW. *Measurements & Measuring instruments*, Sir Issar Pitman & sons (P) Ltd. 1998.
2. Albert D Halfride & William D Cooper, *Modern Electronic instrumentation and measurement techniques*, Prentice Hall of India Pvt Ltd. 1998.

REFERENCE BOOKS

1. Stout MB, *Basic Electrical Measurements*, Prentice Hall of India Pvt Ltd. 1987.
2. Rajendra Prasad, *Electrical Measurements & Measuring instruments*, Khanna Publishers. 1998.
3. Sawhney AK, *A course in Electrical and electronic Measurement and Instrumentation*, Dhanpat Rai & sons, New Delhi, 2001