Government of Karnataka
Department of Technical Education
Board of Technical Examinations, Bengaluru

Course Title:	**ELECTRICAL MEASUREMENTS &MEASURING INSTRUMENTS**	Course Code	: 15EE42T
Semester	: **IV**	Course Group	: **Core**
Teaching Scheme (L:T:P)	: **4:0:0**(in Hours)	Credits	: **4 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **52**
CIE	: **25 Marks**	SEE	: **100 Marks**

Pre-requisites	**:**Basic knowledge about the elements of electrical engineering, electrical circuits, digital and analog electronics.
Course Objectives	**:** To make the students-understand the significance of electrical measurements in the field of engineering , interpret the principle, study the construction, operation and applications of various analog and digital instruments used for measuring electrical and non-electrical quantities, Studythe methods of extending the range of the meters and the calibration techniques.

Course Topics:

Unit No	Unit Name	Hours
1	Characteristics & Classification of instruments.	4
2	Construction & Operation of indicating instruments.	12
3	Construction & Operation of Watt meter & energy meter.	8
4	Measurement of R,L,C.	4
5	Digital meters.	12
6	Transducers & Sensors, Signal Conditioning circuits.	12
	Total	**52**

Course Outcomes

On successful completion of the course, the students will be able to,

1. Understand the Characteristics and Classification of measuring instruments.
2. Explain the construction and operation of indicating instruments.
3. Explain the construction and operation of Watt meters and Energy meters.
4. Interpret the methods of measurements of resistance, inductance and capacitance.
5. Explain digital meters, types, comparison, advantages and disadvantages.
6. Understand different transducers, sensors, and signal conditioning method.

Composition of Educational Components

Questions for CIE and SEE will be designed to evaluate the various educational components (Bloom's Taxonomy) such as:

Sl. No.	Educational Component	Weightage (%)	Total Marks (Out of 145)
1	Remembering	7	10
2	Understanding	70	105
3	Application/ Analysis	23	30
Total		**100**	**145**

Course Outcome linkage to Cognitive Level

Cognitive Level Legend: R- Remember, U- Understand, A- Application

Course Outcome		CL	Linked PO	Teaching Hrs
CO1	Understand the Characteristics and Classification of measuring instruments.	***R/U***	2, 10	4
CO2	Explain the construction and operation of indicating instruments.	***U***	2,10	12
CO3	Explain the construction and operation of Watt meters and Energy meters.	***U/A***	2,10	8
CO4	Interpret the methods of measurements of resistance, inductance and capacitance.	***U/A***	2,10	4
C05	.Explain digital meters, types, comparison, advantages and disadvantages.	***U***	2,10	12
C06	Understand different transducers, sensors, and signal conditioning method.	***R/U/A***	2,10	12
		Total sessions		**52**

Course Content and Blue Print of Marks for SEE:

Unit No	Unit Name	Hour	Max. Marks per Unit	Questions to be set for (5marks) PART - A			Questions to be set for (10marks) PART - B			Marks weightage (%)
				R	U	A	R	U	A	
1	Characteristics & Classification of instruments.	4	10	1				0.5		7
2	Construction & Operation of indicating instruments.	12	35		2			2.5		24
3	Construction & Operation of Watt meter & energy meter.	8	25			1		1	1	17
4	Measurement of R,L,C.	4	10		1				0.5	7
5	Digital meters.	12	35		2			2.5		24
6	Transducers & Sensors, Signal Conditioning circuits.	12	30	1	1			1	1	21
	Total	**52**	**145**	**9 (45 Marks)**			**10 (100 Marks)**			**100**

Course-PO Attainment Matrix

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
Electrical Measurements and Measuring Instruments	-	**3**	-	-	-	-	-	-	-	**3**

LEVEL 3- HIGHLY ADDRESSED, LEVEL 2-MODERATELY ADDRESSED, LEVEL 1-LOW ADDRESSED.

METHOD IS TO RELATE THE LEVEL OF PO WITH THE NUMBER OF HOURS DEVOTED TO THE COS WHICH ADDRESS THE GIVEN PO.
IF ≥40% OF CLASSROOM SESSIONS ADDRESSING A PARTICULAR PO, IT IS CONSIDERED THAT PO IS ADDRESSED AT LEVEL 3
IF 25 TO 40% OF CLASSROOM SESSIONS ADDRESSING A PARTICULAR PO, IT IS CONSIDERED THAT PO IS ADDRESSED AT LEVEL 2
IF 5 TO 25% OF CLASSROOM SESSIONS ADDRESSING A PARTICULAR PO, IT IS CONSIDERED THAT PO IS ADDRESSED AT LEVEL 1
If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

Course Contents:

Unit I

Characteristics& Classification of instruments. 04hrs

Characteristics of instruments, precision, accuracy, sensitivity, resolution, tolerance, errors, types of errors, classification of instruments, necessity of torque instruments & types.

Unit II

Construction & Operation of indicating instruments. 12hrs

Construction and operation of moving coil, moving iron voltmeter and ammeter, calibration and range extension of voltmeter, ammeter, mention the types, applications, advantages and disadvantages.

Unit III

Construction & Operation of Watt meter & energy meter. 08hrs

Construction and operation of wattmeter, measurement of power by two wattmeter method. Energy meter, Calibration of energy meter, mention the types, applications, errors, advantages and disadvantages.

Unit IV

Measurement of Resistance, Inductance and Capacitance. 04hrs

Measurement of unknown resistance by using wheatstone's bridge, Kelvin's double bridge. Measurement of inductance by using Maxwell's bridge. Measurement of capacitance by using Schering Bridge.

Unit V

Digital meters. 12hrs

Block diagram and explain operation of Digital frequency meter, digital synchroscope, digital non contact type tachometer, digital p.f. meter, digital energy meter, digital trivector meter, digital tong tester, digital LCR meter, digital multimeter and voltmeter (only BLOCK DIAGRAMS) and their applications, advantages and disadvantages, comparison with analog meters.

Unit VI

Transducers, Sensors & Signal conditioning circuits. 12hrs

Meaning of transducers, selection of transducers, Need for signal conditioning, block diagram of a.c. and d.c. signal conditioning, applications explain with a circuit diagram, strain gauges LVDT, RVDT, Thermocouple, Pyrometer, Peizo-electric, Opto-sensor, Bolometer for measuring AF & RF power measurements, applications.

Reference Books:

1. Electrical Measurements & measuring instruments by A.K.SawhneyDhanpatRai
2. Electrical Measurements & measuring instruments by R.K.Rajput, S.CHAND Publications
3. **Electronic Measurements**& instrumentation by **R.K.Rajput, S.CHAND Publications**
4. Electrical Measurements & measuring instruments By G.K.BanerjeePHI Publications
6. Instrumentation & Control by D.Patranabis by PHI Publications.
7. Electronic Instrumentation by H.S KALSI, Tata McGRAW HILL

E-Resources:

1. *www.academia.edu/.../A_K.Sawhney-A_course_in_Electrical_and_Elect...*

2.*https://en.wikipedia.org/.../List_of_electrical_and_electronic_measuring_*

3. *Nptel.iitg.ernet.in › ... › Electrical and Electronic Measurements (Video)*

4.*www.npl.co.uk/.../beginners-guide-to-measurement-in-electronic-and-ele..*

Course Delivery:

The Course will be delivered through Lectures, Classroom Interaction, Animations, Group Discussion, Exercises and Assignments.

Course Assessment and Evaluation Scheme:

<table>
<tr><th colspan="2"></th><th>What</th><th>To Whom</th><th>Frequency</th><th>Max Marks</th><th>Evidence Collected</th><th>Course Outcomes</th></tr>
<tr><td rowspan="4">Direct Assessment</td><td rowspan="3">CIE (Continuous Internal Evaluation)</td><td>I A Tests</td><td rowspan="3">Students</td><td>Three tests (average of three)</td><td>20</td><td>Blue Books</td><td>1 to 6</td></tr>
<tr><td></td><td>Student Activity</td><td>05</td><td>Hand written report</td><td>1 to 6</td></tr>
<tr><td></td><td>TOTAL</td><td>25</td><td></td><td></td></tr>
<tr><td>SEE (Semester End Examination)</td><td>End Exam</td><td>Students</td><td>End Of the Course</td><td>100</td><td>Answer Scripts at BTE</td><td>1 to 6</td></tr>
<tr><td rowspan="2">Indirect Assessment</td><td colspan="2">Student Feedback on course</td><td rowspan="2">Students</td><td>Middle Of The Course</td><td colspan="2" rowspan="2">Questionnaire</td><td rowspan="2">1 to 6</td></tr>
<tr><td colspan="2">End Of Course Survey</td><td>End Of The Course</td></tr>
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***CIE** – Continuous Internal Evaluation ***SEE** – Semester End Examination
Note: I.A. test shall be conducted for 20 marks. Average marks of three tests shall be rounded off to the next higher digit.

Suggested Student activity:

Prepare a self hand-written report of minimum 2 pages on any one of the following:(Each group has to carry out the activity individually and report should be maintained).

1. Methods adopted for calibration of digital energy meters in ESCOMS.
2. Standard meters used in nearby industries or substations.
3. Applications of various digital measuring instruments in a particular industry.
4. Applications of various transducers in a particular industry. Mention the purpose.
5. Specifications of various meters.
6. Specifications of various transducers.
7. **Special meters used for detecting cable faults.**
8. **Meggar and Earth tester.**
9. **CTs and PTs.**
10. **Manufacturing process of digital meters.**

MODEL OF RUBRICS / CRITERIA FOR ASSESSING STUDENT ACTIVITY (Course Coordinator)

Dimension	Scale					Students score (Group of five students)				
	1 Unsatisfactory	2 Developing	3 Satisfactory	4 Good	5 Exemplary	1	2	3	4	5
1	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	3				
2	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2				
3	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	5				
4	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	4				
Note: Concerned faculty (Course coordinator) must devise appropriate rubrics/criteria for assessing Student activity for 5 marks **One activity on any one CO (course outcome) may be given to a group of FIVE students** **Grand Average/Total**						14/4 =3.5 ≈4				

Example only: MODEL OF RUBRICS / CRITERIA FOR ASSESSING STUDENT ACTIVITY-
Task given- Industrial visit and report writing

Dimension	Scale					Students score (Five students)				
	1 Unsatisfactory	2 Developing	3 Satisfactory	4 Good	5 Exemplary	1	2	3	4	5
1.Organisation	Has not included relevant info	Has included few relevant info	Has included some relevant info	Has included many relevant info	Has included all relevant info needed	3				
2. Fulfill team's roles & duties	Does not perform any duties assigned	Performs very little duties	Performs partial duties	Performs nearly all duties	Performs all duties of assigned team roles	2				
3.Conclusion	Poor	Less Effective	Partially effective	Summarises but not exact.	Most Effective	5				
4.Convensions	Frequent Error	More Error	Some Error	Occasional Error	No Error	4				
					Total marks	14/4=3.5 ≈4				

FORMAT OF I A TEST QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks
Ex: I test/6 th week of sem 10-11 Am			20
	Year:		
Name of Course coordinator : CO's:____			Units:__

Question no	Question	MARKS	CL	CO	PO
1					
2					
3					
4					

Note: Internal Choice may be given in each CO at the same cognitive level (CL).

MODEL QUESTION PAPER (CIE)- example

Test/Date and Time	Semester/year	Course/Course Code	Max Marks
1st Test/ 6 th week, 9 Feb 17, 10-11 AM	IV SEM, E & E Engg	**Electrical Measurements and Measuring Instruments**	20
	Year: 2015-16	Course code:	
Name of Course coordinator : Units Covered :1 and 2 Course Outcomes : 1 and 2 **Instruction :***(1). Answer all questions (2). Each question carries five marks*			

Question No.	Question	CL	CO	PO
1	Define a).precision b).accuracy c).sensitivity d) resolution e) tolerance f) errors.	R	1	2, 10
2	Explain the necessity of torque in instruments. List the types of torque.	U	1	2, 10
3	Explain the construction and operation of PMMC type moving coil with neat sketch.	U	2	2, 10
4	Design a single range d.c. milliammeter using basic movement with an internal resistance Rm =30ohm and an full deflection current Im=1mA.Range is 0-10mA	U	2	2, 10

Note: Internal Choice may be given in each CO at the same cognitive level (CL).

CL: Cognitive Level, R-Remember, U-Understand, A-Application, PO: Program Outcomes

COURSE CONTENT OF ELECTRICAL MEASUREMENT & MEASURINGINSTRUMENTS

Lesson no/Topic no	Unit	Session/ Duration
I	**Characteristics & Classification of instruments.**	04hrs
1	Define error, precision, accuracy, sensitivity, resolution and tolerance. Explain the types of errors- gross error, random error, systematic error- environmental, observation error and instrumental error.	01
2	Classifications of measuring instruments: Absolute and secondary instruments, types of secondary instruments- indicating, integrating and recording instruments- give examples.	01
3	List the essential torques - Deflecting torque, control torque and damping torque in indicating instruments. Explain how deflecting torque is produced.	01
4	Explain with diagram spring control method (**only**) of producing control torque. Explain with diagrams the methods of producing damping torque- air friction and eddy current methods.	01
II	**Construction & Operation of indicating instruments.**	**12hrs**
5	**Moving coil instruments:** Mention the types, Explain the principle, construction and operation of **PMMC type** instrument.	01
6	**Moving iron instruments:** Mention the types, Explain the principle, construction and operation of **repulsion type** moving iron instrument.	01
7	**Applications of moving coil & moving iron instruments:** Explain how PMMC instrument can be used as an ammeter. Explain how PMMC instrument can be used as an voltmeter. Explain how MI instrument can be used as an ammeter. Explain how MI instrument can be used as an voltmeter. Mention how the PMMC instrument can be used for measuring AC quantities.	01
8	List and explain the errors in PMMC instruments. List and explain the errors in moving iron instruments. Mention the advantages and disadvantages of PMMC instruments. Mention the advantages and disadvantages of moving iron instruments.	01
9	**Calibration:** Define calibration, explain the necessity of calibrating the instruments. Explain with circuit diagram - calibration of voltmeter by comparison method using a standard meter.	01
10	Explain with circuit diagram - calibration of voltmeter by using DC potentiometer.	01

11	Explain with circuit diagram - calibration of ammeter by comparison method using a standard meter.	01
12	Explain with circuit diagram calibration of ammeter by using a DC potentiometer.	01
13	Explain with circuit diagram range extension of DC ammeter using shunts. Write the equations. Solve simple problems on extending the range of DC ammeters.	01
14	Explain with circuit diagram range extension of DC voltmeter using multipliers. Write the equations. Solve simple problems on extending the range of DC voltmeters.	01
15	Range extension of A.C meters using instrument transformers- Explain range extension of A.C ammeters using CT. Explain range extension of A.C voltmeters using PT.	01
16	Explain range extension of wattmeter using CT and PT. Mention the precaution to be taken while opening the secondary of CT. Explain the term burden as referred to instrument transformers.	01
III	**Construction & Operation of Watt meter & energy meter.**	**08hrs**
17	List the types of wattmeter. Explain the principle, construction and operation of single phase electro-dynamometer (electro-dynamic) type wattmeter.	01
18	List and explain errors in wattmeters. List the merits and de-merits of dynamometer type wattmeter.	01
19	Explain with circuit diagram measurement of power by two wattmeter method, solve simple problems.	01
20	Explain calibration of wattmeter by comparison method using a standard meter.	01
21	List the types of energy meter. Explain the principle ,construction and operation of single phase induction type energy meter.	01
22	Explain the errors and adjustments in single phase induction type energy meter.	01
23	Explain calibration of single phase energy meter with circuit diagram.	01
24	Solve simple problems on errors in energy meter	01
IV	**Measurement of Resistance Inductance and Capacitance.**	**04hrs**
25	Classify resistance - low, medium and high. Explain measurement of unknown resistance by using Wheatstone bridge. Solve simple problems.	01

26	Explain measurement of unknown resistance by using Kelvin's double bridge. Solve simple problems.	01
27	Explain measurement of inductance by using Maxwell's bridge. Solve simple problems. (**inductance bridge only**)	01
28	Explain measurement of capacitance by using Schering Bridge. Solve simple problems.	01
V	**Digital meters**	**12hrs**
29	Explain with a general block diagram, the basic building blocks of digital meters. Mention the advantages and dis-advantages of digital meters. Compare analog and digital meters.	01
30	Explain the operation of a digital Voltmeter with a (**general**) block diagram. (showing the basic building blocks like attenuator, signal conditioning, rectifier, analog to digital converter and display).	01
31	Explain the operation of a digital multi-meter with a block diagram.	01
32	Explain the operation of digital tong tester with a (**general**) block diagram. List their applications.	01
33	Explain the operation of digital Energy meter with a (**general**) block diagram.	01
34	Explain the operation of digital frequency meter with a block diagram. List the applications, advantages and disadvantages.	01
35	Explain operation of digital power factor meter with a (**general**) block diagram. List the applications, advantages and disadvantages	01
36	Explain operation of digital synchroscope with a (**general**) block diagram. List the applications, advantages and disadvantages.	01
37	Explain operation of digital non-contact type tachometer with a block diagram. List the applications, advantages and disadvantages.	01
38	Explain the operation of digital tri-vector meter with a (**general**) block diagram. Mention the applications, advantages and disadvantages,	01
39	Explain the operation of a digital LCR meter with a block diagram.	01
40	Explain the operation of a digital LCR meter with a block diagram. Mention the applications.	01

VI	Transducers, Sensors& Signal conditioning circuits.	12hrs
41	Define transducer, classify the various types of transducers and factors / characteristics considered for selection of transducers.	01
42	Explain the need for signal conditioning. Explain the operation of A.C. signal conditioning system with a block diagram.	01
43	Explain D.C. signal conditioning system with a block diagram.	01
44	Explain the operation of a strain gauges (**resistance wire- linear type)** with a diagram. Explain the principle, construction and operation of thermoelectric pyrometer with a diagram. List the applications of thermoelectric pyrometer.	01
45	Explain the operation of an optical pyrometer (**dis-appearing filament type**) with neat diagram. List the applications.	01
46	Explain the operation of LVDT with a diagram. List the applications.	01
47	Explain the operation of RVDT (**Rotary variable differential transformer**) with neat diagram. List the applications.	01
48	Explain the operation of Opto-sensor with a (**general**) diagram. List the applications.	01
49	Explain the operation of Peizo-electric (**device**) transducer with a diagram . List the applications.	01
50	Explain operation of Bolometer for AF power measurement with a block diagram.	01
51	Explain operation of Bolometer for RF power measurement with a block diagram.	01
52	Explain the applications of Bolometer in RF & AF power measurement.	01

Model Question Paper:

Code: 15EE42T

IV Semester Diploma Examination.
ELECTRICAL MEASUREMENTS & MEASURING INSTRUMENTS

Cognitive Level: REMEMBER

1. Define a).precision b).accuracy c).sensitivity d).resolution e).tolerance f).errors.
2. Define error? Mention the types of errors.
3. Define calibration? Mention the merits.
4. List the application MI instruments.
5. List the merits of MI instruments.
6. List the de-merits of MI instruments.
7. List the methods for range extension in D.C ammeter& voltmeter.
8. List the methods for range extension in A.C ammeter& voltmeter.
9. Mention the merits and de-merits of disc type energy meter .
10. List the types of bridges used for measuring unknown R,L,C.
11. List the application of MC instruments.

Cognitive Level: UNDERSTAND

12. Classify the measuring instruments.
13. Explain the necessity of torque in instruments. List the types of torque.
14. Sketch a neat block diagram of digital p.f.meter.
15. Sketch a neat block diagram of digital non contact type tachometer.
16. Sketch a neat block diagram of digital LCR meter.
17. List any 3 applications of Digital frequency meter and Digital synchroscope.
18. List any 3 applications of a)Digital p.f. meter. b)Digital voltmeter.
19. List any 3 applications of a)Digital non contact type tachometer. b)Digital LCR meter.
20. List any 3 applications of a)Digital Multimeter. b)Digital tongtester.
21. List any five applications of trivector meter.
22. List the merits & de-merits of a)Digital frequency meter b)Digital synchroscope.
23. List the de-merits of a)Digital frequency meter. b)Digital synchroscope.
24. List the advantages of a)Digital p.f. meter. b)Digital voltmeter.
25. List the dis-advantages of a)Digital non contact type tachometer. b)Digital LCR meter.
26. Draw a neat block diagram of A.C signal conditioning.
27. Draw a neat block diagram of D.C signal conditioning.
28. List the applications of wattmeter and energy meter.
29. Explain calibration of 1Phase dynamometer type wattmeter.
30. Explain calibration of 1Phase induction type energy meter.
31. Define transducer? List any three types.

32. Explain the operation of Thermocouple with neat diagram.

Cognitive Level: APPLICATION

33. Determine wattmeter constant with wattmeter is having a voltage range of 150/300v and current range of 2.5/5A,with P=625W.
34. Draw a neat block diagram the operation of digital frequency meter.
35. Draw a neat block diagram the operation of digital multimeter meter.
36. Draw a neat block diagram the operation of digital voltmeter.
37. Draw a neat block diagram the operation of digital synchroscope.
38. Draw a neat block diagram the operation of digital tong tester.
39. Explain the operation of resistance wire ,linear type strain gauge with neat diagram.
40. Explain the operation of LVDT with a neat diagram
41. Explain the operation of RVDT with a neat diagram.
42. Explain the operation optical pyrometer with a neat diagram.
43. Explain the operation of Peizo-electric transducer with a neat diagram.
44. Explain the operation of Bolometer for AF power measurement with a neat diagram Explain the operation of Bolometer for RF power measurement with a neat diagram.
45. Illustrate need for signal conditioning. List the applications with a neat diagram.
46. Compare LVDT with RVDT.

UNIT-II

Cognitive Level: UNDERSTAND

47. List any three merits of MC voltmeter.
48. List any 3 merits of MC ammeter.
49. List any 3 demerits of MI voltmeter.
50. List any three demerits of MI ammeter.
51. Explain the construction and operation of PMMC instrument with a neat diagram.
52. Explain the construction and operation of repulsion type moving iron instrument with with a neat diagram.
53. Explain how PMMC instrument can be used as an ammeter and as an voltmeter.
54. Explain how MI instrument can be used as an ammeter and as an voltmeter.
55. Design a single range D.C milli-ammeter using basic movement with an internal resistance Rm=30 ohm and an full deflection current Im=1mA.Range is 0-10mA
56. Describe the calibration ammeter with a neat circuit diagram.
57. A moving coil voltmeter type having a internal resistance of 20Ω gives a full scale deflection with a voltage of 20mV.Calculate the value of multiplier required.
58. Describe the calibration voltmeter with a neat circuit diagram.
59. Compare Shunts with series multipliers.

UNIT-III

Cognitive Level: UNDERSTAND

60. Explain the construction and operation of a dynamometer type wattmeter a with neat diagram.
61. Explain the construction and operation of single phase induction type energy meter with a neat diagram.
62. Describe the calibration of wattmeter with a neat circuit diagram.
63. List the any 3 errors in wattmeters.

Cognitive Level: APPLICATION

64. If the reading s of the two wattmeters connected across the load are 250W and 1.5KW,determinep.f. of the load.
65. The meter constant of 230V,10A energy meter is 1000rev/Kwh.The meter is tested at half load and rated voltage at unity p.f.and found to make 40rev in 65sec.Determine meter error at half load.
66. Describe the calibration of energy meter with a neat circuit diagram.

UNIT-IV

Cognitive Level: UNDERSTAND

67. Explain the measurement of unknown resistance using Wheat stone's bridge .
68. Explain the measurement of unknown resistance using Kelvin's double bridge .
69. Explain the measurement of unknown capacitance using Schering bridge .
70. Explain the measurement of unknown inductance using maxwell's bridge

Cognitive Level: APPLICATION

71. Determine the value resistance required to balance the bridge. If the three arms of the wheat stone's bridge are having resistances of 50ohm,100ohm,150ohm respectively.
72. If the three arms of the wheat stone's bridge are having resistances of 5KΩ,10 KΩ,15 KΩ respectively, find the value of resistance required to balance the bridge.
73. Illustrate the measurement of unknown inductance using Maxwell's bridge.
74. The Schering bridge employs a standard air capacitor C2 of 100pF a non reactive resistance R1 of 300Ω in parallel with variable capacitor C1 and variable resistance R2.Balance is obtained with C1=0.4μF and R2=250Ω calculate the capacitance Cx and resistance Rx.

UNIT-V

Cognitive Level: UNDERSTAND

75. Explain the operation of digital frequency meter with neat block diagram.
76. List any two merits and de-merits of digital frequency meter.
77. Explain the operation of digital synchroscope with neat block diagram..
78. List any two merits and de-merits of digital synchroscope.
79. Explain the operation of digital energy meter with a neat block diagram.
80. List any two merits and de-merits of digital energy meter.
81. Explain the operation of digital P.f. meter with neat block diagram.
82. List any two merits and de-merits of digital p.f. meter.
83. Explain operation of digital LCR meter with neat block diagram.
84. List any two merits and de-merits of digital LCR meter.
85. Explain operation of digital trivector meter with neat block diagram.
86. List any two merits and de-merits of digital trivector meter.
87. Explain operation of digital non contact type tachometer with neat block diagram.
88. List any two merits and de-merits of digital non contact type tachometer.
89. Explain operation of digital tong tester with neat block diagram.
90. List any two merits and de-merits of digital tong tester.
91. Explain operation of digital multimeter with neat block diagram.
92. List any two merits and de-merits of digital multimeter.
93. Explain operation of digital voltmeter with neat block diagram.
94. List any two merits and de-merits of digital voltmeter.
95. Compare analog multimeter with digital multimeter.
96. List any four applications of digital multimeter.
97. Differentiate analogp.f meter with digital p.f.meter.
98. List any four applications of digital p.f. meter.
99. Compare analog frequency meter with digital frequency meter.
100. List any four applications of digital frequency meter.
101. Differentiate analog voltmeter with digital voltmeter.
102. List any four applications of digital voltmeter.
103. Differentiate analog LCR with digital LCR meter.
104. List any four applications of digital LCR meter.

UNIT-VI

Cognitive Level: REMEMBER

105. List any three applications of LVDT.
106. List any three applications of RVDT.
107. List any three applications of thermocouple.
108. List any three applications of Bolometer for AF power measurement.
109. List any three applications of Bolometer for RF power measurement.

110. List any three applications of Peizo-electric transducer.
111. List any three applications of opto-sensor.
112. List any three applications of Pyrometer.

Cognitive Level: UNDERSTAND

113. Explain the necessity of signal conditioning.
114. Explain A.C.signal conditioning system with a neat block diagram.
115. List the four parameters on which transducers can be selected.
116. Explain D.C.signal conditioning system with a neat block diagram.

Cognitive Level: APPLICATION

117. Explain the operation of LVDT with a neat circuit diagram..
118. Explain the operation of RVDT with a neat circuit diagram.
119. Explain the operation of thermocouple with a neat diagram.
120. Explain the operation of Bolometer used for AF power measurement with a neat block diagram.
121. Explain the operation of Bolometer used for RF power measurement with a neat block diagram.
122. Explain operation of Peizo-electric transducer with a neat diagram.
123. Explain operation of opto-sensor with a neat diagram.
124. Explain operation of optical pyrometer with a neat diagram.

Model Question Paper:

Code: 15EE42T

IV Semester Diploma Examination.

ELECTRICAL MEASUREMENTS & MEASURING INSTRUMENTS

[Time: 3 Hours] **[Max. Marks: 100]**

Note: (i)Answer any **SIX** questions from Part – A.(Each question carries 5 marks)

(ii)Answer any **SEVEN** questions from Part – B. (Each question carries 10 marks)

PART - A

1. Define a).precision b).accuracy c).sensitivity d) resolution e) tolerance f) errors. 5

2.Define calibration? Mention the merits. 5

3.Illustrate the methods employed for range extension in D.C ammeter& voltmeter. 5

4.A wattmeter is having a voltage range of 150/300v and current range of 2.5/5A, with P=625W ,determine wattmeter constant 5

5.Classify the types of bridges used for measuring unknown R,L,C 5

6. Write a neat block diagram of digital p.f.meter. 5

7. Define transducer? List any three types of transducers. 5

8. List any three merits &any two de-merits of Digital voltmeter. 5

9. Explain with neat block diagram explain operation of digital tong tester. 5

PART - B

10.a)Define error? Mention the types of errors. 5

b) If the reading s of the two wattmeters connected across the load share 250W and 1.5KW, determine p.f. of the load. 5

11.a)Explain the construction and operation of PMMC type moving coil voltmeter with neat sketch. 7

b).List any three merits of PMMC voltmeter. 3

12a) Describe the calibration a voltmeter with a neat circuit diagram. 6

b) Design a single range d.c milliammeter using basic movement with an internal resistance Rm=30ohm and a full scale deflection current Im=1mA.Range is 0-10mA. 4

13 a) Describe the calibration wattmeter with a neat circuit diagram. 7

b) List the any 3 errors in wattmeters. 3

14.a)Describe the measurement of unknown resistance using Wheat stone's bridge with a neat circuit diagram. 6

b)Determine the value resistance required to balance the bridge. If the three arms of the

wheat stone's bridge are having resistances of 50Ω,100Ω,150Ω respectively, find the value resistance required to balance the bridge. 4

15.a) Explain the block diagram of digital tri-vector meter. 6

b) List any two advantages and disadvantages of digital tong tester. 4

16.a) Explain with a block diagram the operation of digital LCR meter. 6

b)Compare analog frequency meter with digital frequency meter. 4

17.a) Explain LVDT with a neat circuit diagram. 7

b)List any three applications of RVDT. 3

18.a) Explain the block diagram of Bolometer for AF power measurement.7

b)List any three applications of opto-sensor. 3

19.a) Sketch block diagram of digital non contact type digital tachometer. 6

b) Summarize the necessity of signal conditioning? 4

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