CMR ENGINEERING COLLEGE
UGC AUTONOMOUS
Approved by AICTE & Affiliated to JNTU Hyderabad, Medchal Road, Hyderabad.

Department of Electronics & Communication Engineering

COURSE FILE

COURSE INSTRUCTOR NAME: Ms.P .Rani ACADEMIC YEAR:2024-25

SUBJECT NAME: Electronic Measurements & Instrumentation

EMAIL-ID:proddutururani@cmrec.ac.in CLASS ROOM NO: B-211,D-401, D-402

CONTACT NO:6301628593

SEM START DATE AND END DATE: 8-07-24 T0 9-11-24

CONTENTS

HOD

1.Department vision & mission:

Vision of the Institute:

To be recognized as a premiere institution in offering value based and futuristic quality technical education to meet the technological needs of the society

Mission of the Institute:

1. To impart value based quality technical education through innovative teaching and learning methods.
2. To continuously produce employable technical graduates with advanced technical skills to meet the current and future
   technological needs of the society.
3. To prepare the graduates for higher learning with emphasis on academic and industrial research

VISION OF THE DEPARTMENT

To promote excellence in technical education and scientific research in electronics and communication engineering for the benefit of society.

MISSION OF THE DEPARTMENT:

M1: To impart excellent technical education with state of art facilities inculcating values and lifelong learning attitude.

M2: To develop core competence in our students imbibing professional ethics and team spirit.

M3: To encourage research benefiting society through higher learning.

2. List of PEOs and POs PSO's:

PROGRAM EDUCATIONAL OBJECTIVES (PEOs) :

PEO 1: Establish themselves as successful professionals in their career and higher education in the field of Electronics & Communication Engineering and allied domains through rigorous quality education.

PEO 2: Develop Professionalism, Ethical values, Excellent Leadership qualities, Communication Skills and teamwork in their Professional front and adapt to current trends by engaging in lifelong learning

PEO 3: Apply the acquired knowledge & skills to develop novel technology and products for solving real life problems those are economically feasible and socially relevant

PEO 4: To prepare the graduates for developing administrative acumen, to adapt diversified and multidisciplinary platforms to compete globally

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Ability to apply concepts of Electronics & Communication Engineering to associated research areas of electronics, communication, signal processing, VLSI, embedded systems, IoT and allied technologies.

PSO2: Ability to design, analyze and simulate a variety of Electronics & Communication functional elements using hardware and software tools along with analytic skills.

PROGRAM OUTCOMES (POs) :

PO1: **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: **Problem analysis**: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: **Design/Development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice

.

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11:Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12:Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

3. COURSE OUTCOMES and MAPPING WITH POS:

Course Code.CO No	Course Outcomes (CO's)
At the end of the course student will be able to	
CO1	**Discussthe static and dynamic characteristics of measurement system.**
CO2	**Analyze the AC and DC voltmeters and current meters also analyze the signal analyzers.**
CO3	**Discuss the different types of signal generators and oscilloscopes.**
CO4	**Classify and analyze the different types of transducers.**
CO5	**Design the different types of bridges.**
CO6	**Demonstrate the Measurement of Physical Parameters.**

Course Outcome (CO)-Program Outcome (PO) Matrix:

Course Outcomes (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	2	2	-	-	-	-	-	2
CO2	3	3	2	2	3	2	-	-	-	-	2
CO3	3	2	2	1	3	-	-	-	2	-	2
CO4	3	3	2	3	3	3	-	-	2	-	3
CO5	3	3	3	3	3		-	2	2	-	3
CO6	3	2	2	3	3	3	-	2	2	-	3

Course Outcome (CO)-Program Specific Outcome (PSO) Matrix:

Course Outcomes (CO's)	PSO1	PSO2
CO1	2	1
CO2	3	3
CO3	2	3
CO4	3	3
CO5	3	3
CO6	3	3

4. SYLLABUS COPY

ELECTRONIC MEASUREMENTS AND INSTRUMENTATION

UNIT: 1

Block Schematics of Measuring Systems, Performance Characteristics, Static Characteristics, Accuracy, Precision, Resolution, Types of Errors, Gaussian Error, Root Sum Squares formula, Dynamic Characteristics, Repeatability, Reproducibility, Fidelity, Lab ;Measuring Instruments: DC Voltmeters, D'Arsonval Movement, DC Current Meters, AC Voltmeters and Current meters, Ohmmeters, Multi meters, Meter Protection, Extension of Range, True RMS Responding Voltmeters, Specifications of Instruments.

UNIT: 2

Signal Analyzers, AF, HF Wave Analyzers, Harmonic Distortion, Heterodyne wave Analyzers, Spectrum Analyzers, Power Analyzers, Capacitance-Voltage Meters, Oscillators ,Signal Generators: AF, RF Signal Generators, Sweep frequency Generators, Pulse and Square wave Generators, Function Generators, Arbitrary waveform Generator, Video signal Generators, Specifications

.

UNIT: 3

Oscilloscopes: CRT, Block Schematic of CRO, Time Base Circuits, Lissajous Figures, CRO Probes, High Frequency CRO Considerations, Delay lines, Applications:measurement of time, period and frequency Specifications. Special purpose oscilloscopes: Dual Trace, Dual Beam CROs, Sampling oscilloscopes, Storage oscilloscopes, Digit Storage CROs,

UNIT: 4

Transducers: Classification, Strain gauges, Bonded, Unbounded: Force and Displacement Transducers, Resistance Thermometers, Hotwire Anemometers, LVDT, Thermocouples, Synchros. Special Resistance Thermometers, Digital Temperature sensing system. Piezoelectric transducers, Variable Capacitance Transducers, Magneto, strictive Transducers

UNIT:5

Bridges : wheat stone bridge,Kelvin bridge, and Maxwell bridge. Measurement of Physical Parameters: Flow Measurement, Displacement Meters, Liquid level Measurement, Measurement of Humidity and Moisture, Velocity , Force, Pressure-High Pressure Vacuum Level, Temperature-Measurements, Data Acquisition System

TEXT BOOKS:

1. Modern Electronic Instrumentation and Measurement Techniques: A.D. Helbincs, W. D. Cooper: PHI 5th Edition 2003.

2. Electronic Instrumentation: H. S. Kalsi – TMH, 2nd Edition 2004.

REFERENCE BOOKS:

1. Electrical and Electronic Measurement and Measuring Instruments – A K Sawhney, Dhanpat Rai & Sons, 2013.
2. Electronic Instrumentation and Measurements – David A. Bell, Oxford Univ. Press, 1997.
3. Industrial Instrumentation: T.R. Padmanabham Springer 2009.
4. Electronic Measurements and Instrumentation – K. Lal Kishore, Pearson Education 2010.

5. INDIVIDUAL TIME TABLE:

SUBJECT:EMI **SECTION:IVA,B&C** **NAME: P RANI**

DAY& TIME	I (9.10AM-10.10AM)	II (10.10AM - 11.00AM)	III (11.00AM-11.50AM)	IV (11.50AM-1240PM)	12.40-1.20	V (1.20PM-2.20PM)	VI (2.20PM-3.10PM)	VII (3.10PM-4.00PM)
MON	EMI-A		EMI-C		LUNCH BREAK		EMI-A	EMI-B
TUE	EMI-C		EMI-B				EMI-C	
WED		EMI-C		EMI-B				EMI-A
THU	EMI-B		EMI-C				EMI-A	
FRI		EMI-B		EMI-C		EMI-A	EDC LAB	
SAT			EDC LAB			EMI-B	EMI-A	EMI-B

6. DETAILED LECTURE PLAN:

UNIT NO.	NAME OF THE UNIT	NO.OF LECTURES REQUIRED
UNIT I	Block Schematics of Measuring Systems	09
UNIT II	Signal Analyzers and Signal Generators	11
UNIT III	Oscilloscopes	10
UNIT IV	Transducers	09
UNIT V	Bridges	10

7. SESSION PLAN/LESSON PLAN:

S.NO	TOPIC TO BE COVERED	Suggested Books (Eg. T1, T2,R5)	NO. OF LECTURES REQUIRED	Remarks
	UNIT – I			**No.of periods required= 9**
1.	Performance characteristics of instruments, Static characteristics, Accuracy, Resolution	T1,T2,R2,R4	L1	
2.	Precision, Expected value, Error, Sensitivity, Errors in Measurement	T1,T2,R2,R4	L2,L3	
3.	Dynamic Characteristics, speed of response,	T1,T2,R2,R4	L4	
4.	Fidelity, Lag and Dynamic error. DC Voltmeters	T1,T2,R2,R4	L5	
5	-Multirange, Range extension/Solid state and differential voltmeters, AC voltmeters -multi range, range extension, shunt	T1,T2,R2,R4	L6,L7	
6	Thermocouple type RF ohmmeter, Ohmmeters series type, shunt type,	T1,T2,R2,R4	L8,L9	
7	Miltimeter for Voltage, Current and resistance measurements.	T1,T2,R2,R4	L10	
No.of periods required				11
UNIT-II				
9	Signal Generator -fixed and variable	T1,T2,R2,R4	L11	
10	Wave Analyzers,power analyzer,Spectrum Analyzer,Osillators.	T1,T2,R2,R4	L12	
11	Standard and AF sine and square wave Signal generators	T1,T2,R2,R4	L13	
12	Function Generators, Square pulse,Video Signal Generator &	T1,T2,R2,R4	L14	

	Specifications.			
13	Random noise, Sweep waveform	T1,T2,R2,R4	L15	
14	Harmonic distortion analyzers	T1,T2,R2,R4	L16	
15	Arbitary waveform,Capacitance-Voltage meters	T1,T2,R2,R4	L17	
16	Problems	T1,T2,R2,R4	L18	
17	Problems	T1,T2,R2,R4	L19	
18	Problems	T1,T2,R2,R4	L20	
19	Problems	T1,T2,R2,R4	L21	
20	Illustrative problems	T1,T2,R2,R4	L22	
	UNIT-III			**No.of periods required =10**
21	**Special Purpose Osilloscopes:**Dual trace oscilloscope, sampling oscilloscope	T1,T2,R2,R4	L23	
22	digital storage oscilloscope,.Dual beam CRO's,Digital storage CRO's	T1,T2,R2,R4	L24	
23	**Oscilloscopes:CRT;**Block Schematis of CRO	T1,T2,R2,R4	L25	
24	Time base circuits, Lissajous figure	T1,T2,R2,R4	L26	
25	CRO probes,high freguency CRO consideration	T1,T2,R2,R4	L27	
26	Delay Lines,Apllications	T1,T2,R2,R4	L28	
27	Apllications:measurement of time	T1,T2,R2,R4	L29	
28	Period and freguency Specifications	T1,T2,R2,R4	L30	
29	Problems	T1,T2,R2,R4	L31	
30	Problems	T1,T2,R2,R4	L32	

	UNIT-IV			**No.of periods required= 9**
31	**Transducers**: Classifications	T1,T2,R2,R4	L33	
32	Strain Guages,Bounded,unbounded	T1,T2,R2,R4	L34,L35	
33	Force & displacement Transducers	T1,T2,R2,R4	L36	
34	Resistance thermometers	T1,T2,R2,R4	L37	
35	Hotwire Anemometers	T1,T2,R2,R4	L38	
36	LVDT,thermocouple	T1,T2,R2,R4	L38	
37	Synchros	T1,T2,R2,R4	L39	
38	Special Resistance	T1,T2,R2,R4	L40	
	UNIT-V			**No.of periods required= 10**
39	**Bridges:** Wheat stone bridge,Kelvin bridge, Maxwell's bridge	T1,T2,R2,R4	L41	
40	**Measurement Of physical parameters:** Flow measurement	T1,T2,R2,R4	L42	
41	Displacement meters,liquid level measurement,	T1,T2,R2,R4	L43	
42	Measurement of humidity & moisture	T1,T2,R2,R4	L44	
43	Velocity,Force Pressure	T1,T2,R2,R4	L45	
44	High pressure,vacuum lavel	T1,T2,R2,R4	L46	
45	Temperature, measurement	T1,T2,R2,R4	L47	
46	Data Acquisition systems	T1,T2,R2,R4	L48	

8. SESSION EXECUTION LOG:

S .no	Syllabus	No. Classes	Remarks
1	I-UNIT	10	COMPLETED
2	II-UNIT	12	COMPLETED
3	III-UNIT	11	COMPLETED
4	IV-UNIT	10	COMPLETED
5	V-UNIT	11	COMPLETED

9. ASSIGNMENT QUESTIONS:

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IV.B.TECH I-SEM I- MID ASSIGNMENT QUESTIONS SUBJECT: EMI

SET - 1

1. A 200ohm basic movement is to be used as an ohmmeter requiring full scale deflection of

1mA and internal battery voltage of 5V. A half scale deflection marking of 2Kom is desired.

Calculate i) The values of R1 and R2

ii) Maximum value of R2 to compensate for a 3% drop in battery voltage. (BTL 3)(CO2)

2. With a neat sketch explain the operation of series type ohmmeter. Also explain how it is calibrated.

(BTL 2)(CO2)

3. Draw the block schematic of AF wave Analyzer and explain. (BTL 2)(CO2)

4. With a neat diagram explain the working of Pulse and Square wave Generator.(BTL 2)(CO3)

5. Draw the block diagram of CRT. Explain different types of deflections in a CRT.(BTL 2)(CO3)

SET 2

1. Explain the working of a True RMS voltmeter with the help of a suitable block diagram.(BTL2)(CO2)

2. The expected value of the current through a resistor is 20mA.However the measurement yields a current value of 18mA. Calculate

i)Absolute Error

ii)Percentage of Error

iii)Relative Accuracy

iv)Percentage Accuracy (BTL 3)(CO2)

3. Explain about Spectrum Analyzer with a neat block diagram. (BTL 2)(CO3)

4. Explain Function Generator with neat Diagram. (BTL 2)(CO3)

5. Explain working principle operation of CRO with neat diagram. (BTL 2)(CO3)

SET 3

1. Draw the block diagram of Multimeter and explain its function detail. (BTL2)(CO2)

2. A 1mA meter movement having an internal resistance of 100ohm is used to convert into a multi range ammeter having the range 0-10mA, 0-20mA and 0-50mA. Determine the value of the shunt resistance required. (BTL 2)(CO2)

3. Explain the working of Power Analyzer with a neat diagram. (BTL 2)(CO3)

4. Write in detail about signal Generator with a neat sketch. (BTL 2)(CO3)

5. Discuss the various features of the CRT. (BTL 2)(CO3)

IVB.TECH. I SEM MID-2 ASSIGNMENT QUESTIONS SUBJECT: EMI

SET 1

1. Explain the operation of a Digital Storage Oscilloscope with its block diagram(BTL2)(CO2)

2. List any three classifications of transducers? (BTL 2)(CO3)

3. Explain about Displacement Transducer. (BTL 4)(CO2)

4. An unbalanced wheat stone bridge has the following resistances with R1=200

KΩ, R2=400 KΩ, R3=100 KΩ, R4=30 KΩ with a battery voltage of 1.5V and

a galvanometer resistance of Rg=100 Ω. Calculate the current through the galvanometer?(BTL3(CO3)

5. Why the Kelvin's Double Bridge is preferred? Derive the bridge balancing equation for the Kelvin's double Bridge.(BTL 2)(CO3)

SET 2

1. Explain the working of dual-beam CRO with relevant diagrams. (BTL 4)(CO2)

2. Explain the principle of operation of strain gauges with the help of neat diagrams (BTL 2)(CO3)

3. Briefly discuss the working of LVDT with neat block Diagram. (BTL 2)(CO2)

4. Explain the operation of Maxwell Bridge. (BTL 2)(CO3)

5. Wheat stone's bridge has the following parameters R1=10K, R2=15K and

R3=40K. Find the unknown resistance Rx. (BTL3)(CO3)

SET 3

1. Explain the working of dual-trace CRO with relevant diagrams (BTL 2)(CO2)

2. Explain the operation of Sampling Oscilloscope with its block diagram(BTL 2)(CO2)

3. A Maxwell bridge is used to measure an inductive impedance. The bridge

constants at balance are C1 = 0.01μF, R1 = 470 KΩ, R2 = 5.1 KΩ and R3 = 100 Ω.

Find the series equivalent of the unknown impedance. (BTL 3)(CO3)

3. With a neat sketch explain the Wheat Stone Bridge. (BTL 2)(CO3)

4. How Humidity can be measured using transducers. (BTL 2)(CO3)

10. SAMPLE ASSIGNMENT SCRIPT:

(Attached separately)

11. UNIT WISE COURSE MATERIAL:

EMI 5 UNITS NOTES.rar

12. MID EXAM QUESTION PAPERS:

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IV.B.TECH-I-SEM-I MID EXAMINATIONS, DATE:06/09/2024 TIME:10:00AM TO11:30 AM

SUBJECT: EMI BRANCH: Common to CSE&ECE MARKS: 25 M

Note: Question paper contains two parts, Part - A and Part - B.
Part-A is compulsory which carries 10 marks. Answer all questions in part-A
Part-B consists of (21/2) units. Answer any one full question from each unit. Each question carries 5 marks and may have a, b, c sub questions.

PART A 5 x2=10 Marks

1. Define Precision. (BTL 1)(CO1)
2. Define Reproducibility. (BTL 1)(CO1)
3. State the applications of Pulse and Square Wave generator. (BTL 1)(CO3)
4. What is known as Duty Cycle? (BTL 2)(CO3)
5. Define Deflection Sensitivity of a CRT? (BTL 2)(CO3))

PART B 3 x5=15 Marks

6. Draw the block diagram of Multimeter and explain its function detail. (BTL2)(CO2)

(OR)

7. The expected value of the current through a resistor is 20mA.However the measurement yields a current value of 18mA. Calculate
i)Absolute Error
ii)Percentage of Error
iii)Relative Accuracy

iv)Percentage Accuracy (BTL 3)(CO2)
8. Draw the block schematic of AF wave Analyzer and explain. (BTL 2(CO3)

(OR)

9. Explain Function Generator with neat Diagram. (BTL 2)(CO3)
10. Explain working principle operation of CRO with neat diagram. (BTL 2)(CO3)

(OR)

11. Explain the working of a Vertical Amplifier with a relevant circuit diagram. (BTL 2)(CO3)

SCHEME OF EVALUATION:

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BRANCH: Common to CSE&ECE **Subject: EMI**
Year: IV-I **Date: 06/09/2024**
Total marks: 25 **Time: 10 A.M To 11:30 A.M**

S.NO	THEORY	MARKS	TOTAL MARKS
	PART-A		
1	Definition of Precision	2	2
2	Definition Reproducibility	2	2
3	Any 2 applications	2	2
4	Definition of Duty Cycle	2	2
5	Definition of Deflection Sensitivity	2	2
	PART-B		
6	Block diagram	3	5
	Explanation	2	
7	Given Data	1	5
	i)Absolute Error	1	
	ii)Percentage of Error	1	
	iii)Relative Accuracy	1	
	iv)Percentage Accuracy	1	
8	Block diagram	3	5
	Explanation	2	
9	Block diagram	3	5
	Explanation	2	
10	Block diagram	3	5
	Explanation	2	

11	Block diagram	3	5
	Explanation	2	

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IV.B.TECH-I-SEM-II MID EXAMINATIONS, Date:16/11/2024 Time: 10:00 AM TO 11:30 AM

Subject: EMI Branch: CSE Marks: 25 M

Note: Question paper contains two parts, Part - A and Part - B.

Part-A is compulsory which carries 10 marks. Answer all questions in part-A.

Part-B consists of (21/2) units. Answer any one full question from each unit. Each question carries 5 marks and may have a, b, c sub questions.

PART A 5 x2=10 Marks

1. 1 Define Transducer and list out its Applications? (BTL 2)(CO4)
2. Draw Syncro Diagram. (BTL 3)(CO4)
3. What is meant by balancing a bridge? (BTL 2)(CO5)
4. Draw the block diagram of Data Acquisition Systems. (BTL 1)(CO6)
5. What is the Principle of operation of Strain Gauges? (BTL 2)(CO4)

PART B 3 x5=15 Marks

6 . Explain about Thermocouple with neat diagrams? (BTL 2)(CO3)

(OR)

7. Explain the working of Dual-beam CRO with relevant diagrams. ? (BTL 1)(CO4)

8. Briefly discuss the working of LVDT with neat block Diagram. (BTL 2)(CO4)

(OR)

9. Explain about Gyroscopes with neat Block Diagram? (BTL 3)(CO6)

10. Discuss about Data Acquisition System. (BTL 2)(CO6)

(OR)

11. How Humidity can be measured by using Transducer Explain with neat Circuit Diagram? (BTL 2)(CO4)

SCHEME OF EVALUATION:

S.NO	THEORY	MARKS	TOTAL MARKS
	PART-A		
1	Transducer and applications	2	2
2	Synchro Diagram	2	2
3	Definition of balancing a bridge	2	2
4	the block diagram of Data Acquisition Systems	2	2
5	operation of Strain Gauges	2	2
	PART-B		
6	Block diagram	3	5
	Explanation	2	
7	Block diagram	3	5
	Explanation	2	
8	Block diagram	3	5
	Explanation	2	
9	Block diagram	3	5
	Explanation	2	
10	Block diagram	2	5
	Explanation	3	
11	Block diagram	3	5
	Explanation	2	

13. SAMPLE MID ANSWERS SCRIPTS:

(Attached Separately)

14. MATERIAL COLLECTED FROM INTERNET OR WEBSITES:

1. https://www.youtube.com/watch?v=NPzcK3wqKQo&t=129s

2.https://www.youtube.com/watch?v=HnaE3Bcxc-U

3 https://www.youtube.com/watch?v=o19CT-s-k-c

4. https://www.youtube.com/watch?v=X2lqQzi4b9w

5. https://www.youtube.com/watch?v=kCINSjzQ7aU

6. https://www.youtube.com/watch?v=BlgCIWfGww8

7. https://www.youtube.com/watch?v=gAhPQtLFvyU

15. POWER POINT PRESENTATIONS (PPTS):

New WinRAR archive (2).rar

16. BLOOM'S TAXONOMY:

REVISED Bloom's Taxonomy Action Verbs

Definitions	I. Remembering	II. Understanding	III. Applying	IV. Analyzing	V. Evaluating	VI. Creating
Bloom's Definition	Exhibit memory of previously learned material by recalling facts, terms, basic concepts, and answers.	Demonstrate understanding of facts and ideas by organizing, comparing, translating, interpreting, giving descriptions, and stating main ideas.	Solve problems to new situations by applying acquired knowledge, facts, techniques and rules in a different way.	Examine and break information into parts by identifying motives or causes. Make inferences and find evidence to support generalizations.	Present and defend opinions by making judgments about information, validity of ideas, or quality of work based on a set of criteria.	Compile information together in a different way by combining elements in a new pattern or proposing alternative solutions.
Verbs	• Choose • Define • Find • How • Label • List • Match • Name • Omit • Recall • Relate • Select • Show • Spell • Tell • What • When • Where • Which • Who • Why	• Classify • Compare • Contrast • Demonstrate • Explain • Extend • Illustrate • Infer • Interpret • Outline • Relate • Rephrase • Show • Summarize • Translate	• Apply • Build • Choose • Construct • Develop • Experiment with • Identify • Interview • Make use of • Model • Organize • Plan • Select • Solve • Utilize	• Analyze • Assume • Categorize • Classify • Compare • Conclusion • Contrast • Discover • Dissect • Distinguish • Divide • Examine • Function • Inference • Inspect • List • Motive • Relationships • Simplify • Survey • Take part in • Test for • Theme	• Agree • Appraise • Assess • Award • Choose • Compare • Conclude • Criteria • Criticize • Decide • Deduct • Defend • Determine • Disprove • Estimate • Evaluate • Explain • Importance • Influence • Interpret • Judge • Justify • Mark • Measure • Opinion • Perceive • Prioritize • Prove • Rate • Recommend • Rule on • Select • Support • Value	• Adapt • Build • Change • Choose • Combine • Compile • Compose • Construct • Create • Delete • Design • Develop • Discuss • Elaborate • Estimate • Formulate • Happen • Imagine • Improve • Invent • Make up • Maximize • Minimize • Modify • Original • Originate • Plan • Predict • Propose • Solution • Solve • Suppose • Test • Theory

Anderson, L. W., & Krathwohl, D. R. (2001). A taxonomy for learning, teaching, and assessing, Abridged Edition. Boston, MA: Allyn and Bacon.

Action Words for Bloom's Taxonomy					
Knowledge	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
define	explain	solve	analyze	reframe	design
identify	describe	apply	compare	criticize	compose
describe	interpret	illustrate	classify	evaluate	create
label	paraphrase	modify	contrast	order	plan
list	summarize	use	distinguish	appraise	combine
name	classify	calculate	infer	judge	formulate
state	compare	change	separate	support	invent
match	differentiate	choose	explain	compare	hypothesize
recognize	discuss	demonstrate	select	decide	substitute
select	distinguish	discover	categorize	discriminate	write
examine	extend	experiment	connect	recommend	compile
locate	predict	relate	differentiate	summarize	construct
memorize	associate	show	discriminate	assess	develop
quote	contrast	sketch	divide	choose	generalize
recall	convert	complete	order	convince	integrate
reproduce	demonstrate	construct	point out	defend	modify
tabulate	estimate	dramatize	prioritize	estimate	organize
tell	express	interpret	subdivide	find errors	prepare
copy	identify	manipulate	survey	grade	produce
discover	indicate	paint	advertise	measure	rearrange
duplicate	infer	prepare	appraise	predict	rewrite
enumerate	relate	produce	break down	rank	role-play
listen	restate	report	calculate	score	adapt
observe	select	teach	conclude	select	anticipate
omit	translate	act	correlate	test	arrange
read	ask	administer	criticize	argue	assemble
recite	cite	articulate	deduce	conclude	choose
record	discover	chart	devise	consider	collaborate
repeat	generalize	collect	diagram	critique	collect
retell	give examples	compute	dissect	debate	devise
visualize	group	determine	estimate	distinguish	express
	illustrate	develop	evaluate	editorialize	facilitate
	judge	employ	experiment	justify	imagine
	observe	establish	focus	persuade	infer
	order	examine	illustrate	rate	intervene
	report	explain	organize	weigh	justify
	represent	interview	outline		make
	research	judge	plan		manage
	review	list	question		negotiate
	rewrite	operate	test		originate
	show	practice			propose
	trace	predict			reorganize
	transform	record			report
		schedule			revise
		simulate			schematize
		transfer			simulate
		write			solve
					speculate
					structure
					support
					test
					validate

Center for University Teaching, Learning, and Assessment http://uwf.edu/cutla/SLO/ActionWords.pdf

17. INNOVATION TEACHING METHODS (IF ANY):

B.TECH- IV YEAR- I SEMESTER

EMI

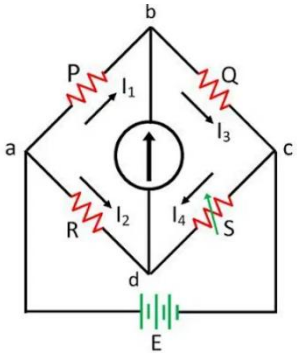
INNOVATIVE ASSIGNMENT-I

1.Design RMS Detector for a Wideband Voltmeter (Product Based)

2.Distance Measurement Using Ultrasonic Sensor (Project Based)

3.The method of 300MHz isolated handheld oscilloscope design (Paper Based)
https://ieeexplore.ieee.org/document/9101593

4.Consider a Wheatstone bridge comprising four resistances 200Ω, 20Ω, 400Ω, and 40Ω. When the bridge is connected to a 1.5 V battery, what will be the current through the individual resistors? (Problem Based)



INNOVATIVE ASSIGNMENT-II

1. Build Your Own Logic Probe (Product Based).

2. Street Light that Glows on Detecting Vehicle Movement Circuit (Project Based)

3. An analog front end design for GSPS oscilloscope (Paper Based)

https://ieeexplore.ieee.org/document/9101869

4. In Maxwell's capacitance bridge for calculating unknown inductance, the various values at balance are, R1 = 300 Ω, R2 = 700 Ω, R3 = 1500 Ω, C4 = 0.8 μF. Calculate R1, L1 and Q factor, if the frequency is 1100 Hz. (Problem Based)

17. EMI TUTORIAL FOR MID I :

1. A 200ohm basic movement is to be used as an ohmmeter requiring full scale deflection of 1mA and internal battery voltage of 5V. A half scale deflection marking of 2Kom is desired. Calculate

i) The values of R1 and R2

ii) Maximum value of R2 to compensate for a 3% drop in battery voltage. (BTL 3)(CO2)

2. The expected value of the current through a resistor is 20mA.However the measurement yields a current value of 18mA. Calculate

i)Absolute Error

ii)Percentage of Error

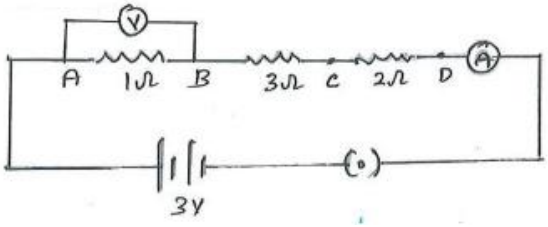
iii)Relative Accuracy

iv)Percentage Accuracy (BTL 3)(CO2)

3. A 1mA meter movement having an internal resistance of 100ohm is used to convert into a multi range ammeter having the range 0-10mA, 0-20mA and 0-50mA. Determine the value of the shunt resistance required. (BTL 2)(CO2)

4. A Signal Generator having a source resistance of 50Ω is set to generate 1KHz sine wave. Open Circuit Terminal Voltage is 10V Peak to Peak. Connecting a Capacitor across the terminals reduce the voltage to 8V peak to peak. Find out the value of this Capacitor? (BTL 2)(CO2)

5. How would the reading 8 voltmeter (V) change it it is connected between B and c? (BTL 3)(CO2)



EMI TUTORIAL FOR MID II :

1.An unbalanced wheat stone bridge has the following resistances with R1=200 KΩ, R2=400 KΩ, R3=100 KΩ, R4=30 KΩ with a battery voltage of 1.5V and a galvanometer resistance of Rg=100 Ω. Calculate the current through the galvanometer? (BTL3(CO3)

2.Wheat stone's bridge has the following parameters R1=10K, R2=15K and R3=40K. Find the unknown resistance Rx. (BTL3)(CO3)

3.A Maxwell bridge is used to measure an inductive impedance. The bridge constants at balance are C1 = 0.01μF, R1 = 470 KΩ, R2 = 5.1 KΩ and R3 = 100 Ω. Find the series equivalent of the unknown impedance. (BTL 3)(CO3)

4.The output of LVDT is 1.45V at Maximum displacement at load of 0.9mΩ, the derivation of linearity is maximum and it is ±0.0035V.Determine the Linearity. (BTL 3)(CO2)

5.A venturimeter is used to measure liquid flow rate of 7500 litres per minute. The difference in pressure across the venturimeter is equivalent to 8 m of the flowing liquid. The pipe diameter is 19 cm. Calculate the throat diameter of the venturimeter. Assume the coefficient of discharge for the venturimeter as 0.96. (BTL 2)(CO2)

18. UNIVERSITY QUESTION PAPERS/ QUESTION BANK:

New WinRAR archive.rar

18. REFERENCES (TEXTBOOKS/WEBSITES/JOURNALS):

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2. Electronic Instrumentation and Measurements – David A. Bell, Oxford Univ. Press, 1997.
3. Industrial Instrumentation: T.R. Padmanabham Springer 2009.
4. Electronic Measurements and Instrumentation – K. Lal Kishore, Pearson Education 2010.

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1. Modern Electronic Instrumentation and Measurement Techniques: A.D. Helbincs, W. D. Cooper: PHI 5th Edition 2003.
2. Electronic Instrumentation: H. S. Kalsi – TMH, 2nd Edition 2004.

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www.geeksforgeeks.org, www.schools.com, Coursera,edx,Udemy, Khan Academy, NPTEL etc along Registration Procedures

1. **https://www.electricalvolt.com/2023/01/definition-of-accuracy-precision-resolution-range/**
2. **https://instrumentationtools.com/darsonval-movement/#**
3. **https://www.ques10.com/p/4645/explain-heterodyne-type-wave-analyzer-and-its-appl/**
4. **https://onlinecourses.nptel.ac.in/noc23_ee105/preview**
5. **https://www.coursera.org/learn/sensors-circuit-interface**
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7. **https://www.youtube.com/watch?v=r7XMje25BFM&list=PLwAOmydmnlw2xKoemZSGsupZFXAvtM0Iw**

8.**https://www.youtube.com/watch?v=8Zhufd64rGg**

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   https://epjtechniquesandinstrumentation.springeropen.com/
2. Development and Validation of Testing System for Automated Millimeter-Wave Phased Array Multi-Beam Near-Field Measurement | IEEE Journals & Magazine | IEEE Xplore
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