STATE BOARD OF TECHNICAL EDUCATION & TRAINING::AP, VIJAYAWADA

DIPLOMA IN ELECTRONICS & COMMUNICATION ENGG.

III SEMESTER

MEASUREMENTS & NETWORK ANALYSIS LA (EC-310)

MANUAL (AS PER C-20 CURRICULUM)

INTRODUCTION

1.0 INTRODUCTION

The Curriculum of Technical Education should invariably provide for knowledge, attitudes and skills required by the technicians /technologists in the country. In this context the laboratory courses form a vital portion in the entire curriculum of technician education. The laboratory courses shall therefore be so designed and delivered that they help the students acquire attitudes and motor skills that are essential to function effectively as technicians/technologists.

The planning, organization and implementation of lab courses need a detailed description of tasks to be performed by the students. Well thought out instructional objectives to a large extent give these descriptions. The analysis of tasks (by identifying the activities the students are expected to do) help prepare the objectives meticulously. In other words the objectives would be clearer, when the task analysis is done to spell out the sub tasks for each objective.

A survey of the practices currently followed in the technical/technician education shows an urgent need to plug in gaps in instructional procedures. The reasons for these gaps are ambiguity in the minds of the teachers regarding tasks to be performed, levels of competency to be achieved by the students and the weightage to be allocated for each task.   This aids in scientific design of instructional plan (optimizing the resources, budgeting the time & content).

The task analysis, teaching points and the structured scheme of evaluation are very important in focusing the instruction on specific skill of desired outcome and in evaluating the same. The Instruction and evaluation in Laboratory courses are different from that of cognitive lessons in the sense that adequate importance and hence weightage needs to be given for all three domains of learning viz. cognitive, psychomotor and affective. Since both training and evaluation of traits of affective domain are practically difficult, a few traits (called values) most relevant and essential to occupations/professions after the Course may be identified for the purpose. It is imperative to integrate these values during instruction and evaluation and also overtly notify the same to the students.

A technician, in addition to performing a skill needs to prepare a report of testing that includes the description of procedure, details of measurements made, reasoning based inferences and so on.,. The current practice of record writing has failed to achieve this purpose as most of the time students end up with making copies of available material.

Therefore, for sensitizing the need for the changes in laboratory instruction, the present hand book has been prepared to meet the above requirements. As such the hand book comprises four parts that intend to :

- Present task analysis, teaching points which can be used for effective design of instruction

- provide a scheme of evaluation with rationally allocated weightage to each significant skill component

- offer a set of questions designed at different levels of competencies for assessment enabling the teacher to set the question paper with balanced levels of competencies

- present pre set worksheets that cultivate the habit of systematic recording of observations and writing the technical report.

- Provide all important data related to particular laboratory activity at one point in the form of annexure

1.1. STRUCTURE OF THE BOOK

The hand book is presented in four parts viz., Laboratory sheets, Worksheet, Experimental Methodology and Annexure. The description of each part is given in the following sections

Part I. Laboratory Sheet

The information provided in this part is useful for the teacher for designing the instruction, planning & organization of the experiment and for scientific evaluation of the students. The major features of the Laboratory sheet are further explained below.

1. **Objective**

   It indicates the **Task** to be performed and completed by the student during the specified duration of time.

2. **Task Analysis**

   It is the process of identifying the component activities (sub tasks) to be carried out by the student in order to achieve the stipulated objective. As the task analysis aim at fitting the instructional objectives into various classes of behaviour, it would help the teacher to determine any particular type of behaviour the student has learnt / failed to perform.

   The task analysis would help the teacher in identifying the specific activities to be performed by the students. This could also be used as some kind of check list to compare with activities planned for the laboratory. Further it would give clue to the teacher to make students think originally & act independently. It includes both psychomotor learning and the related cognitive information and hence the task analysis is presented as Knowledge and skill parts.

   A. Knowledge Part: That includes the cognitive aspects of the task.

   B. Skill Part: That includes Psychomotor & Affective aspects of the task.

3. **Teaching Points:**

   This includes the points based on the SKILL identified with suggested duration for each point and total duration which helps the teacher for the time and content budgeting during instruction.

4. **Need and Scope:**

The purpose, application and scope of the task to be performed are normally included in this sub section.

5. Planning and Organisation:

It lists actions to be taken to perform various activities and hence useful in planning the instruction and organizing the resources and equipment

6. **Scheme of Valuation:**

The information provided in this section helps the teacher to devise a tool for rational measurement assessment of the competencies accomplished by the student.

Part II.   Work Sheet

It is designed for the student, where in the student enters his personal data of identification, details of the experiment, stepwise procedure, observations made during experiment, a sample calculation, free hand typical graph, graph from experimental data and inference with discussion.

Part III. Experimental Methodology

This section furnishes information with regard to standard procedure to conduct the experiment along with the description of equipment/apparatus and the basic theory/concept involved in the conduct of the experiment. Thus this section is very useful for both teacher and student as well to conduct the experiment systematically. Thus this section is presented in four sub section as described below:

➢ **Description**

It gives the detailed description of apparatus / tools / equipment / materials to be used for the task.

➢ **Theory / Concept**

It gives the concept of the task to be performed with formulae and units.

➢ **Procedure**

It provides the idea of step wise procedure to perform the task.

➢ **Observation and Calculation**

It includes sample observation, sample graph, sample calculation for reference

Part IV. Annexure

All important and useful information that may help in accomplishment of tasks like conversion tables for units, technical & scientific data like material properities, standard trend or characteristic curves (graphs) etc are compiled and presented at one place in this section.

1.2. WHO IS TO USE AND HOW TO USE.

The hand book is so designed that it can be beneficially used by different sections of the technical education viz., the teacher, the student, the examiner and the administrator convenient to individual's requirements. A few uses of this hand book each stakeholder could make is outlined in the following sections.

1. Teacher

A. The **laboratory sheet** is designed keeping the teacher in mind for the teacher has key responsibility of imparting the skills to the student and hence the information given in the lab sheets may be useful for planning & organizing the experimental set up and designing an effective instruction. Thus the teacher may

Plan and organize as per *section 4*,

Instruct the students as per *section 2*,

Demonstrate each sub task as per *section1.B*.and

Evaluate the students as per *section 5*, according to the level of competency.

Values: The values in a person are an important personality trait that needs to be nurtured in the learning environment. Further it is also a driving component in any individual to deliver the best and hence this component is also included in the evaluation. However only five key dimensions, that are important in the teaching-learning environment, are taken into consideration for nurturing and evaluation. A little information about these five dimensions is given below as a guideline for the teacher while assessing students.

1. Co-operation: It is the voluntary arrangement in which two or more students engage in a mutually beneficial exchange, instead of competition. Cooperation can happen where resources adequate for both students exist or are created by their interaction.

2. Co-ordination: It is the unification, integration, synchronization of the effect of group members so as provide unity of action in the pursuit of common goals. It is an integral element and required in each & every function and at each & every stage & therefore it cannot be separated.

3. Communication; Communication skill is the set of skills that enables a student to convey information so that it is received and understood.

4. Sharing: A part or portion belonging to, distributed to, contributed by, owed by a person or a group **Or** To participate in, use, enjoy or experience jointly or in turns.

s5. Leadership: Students with the following leadership qualities are almost always the ones that rise above the crowd.

1. Trustworthiness: This refers to integrity.

2. Inspiration: Guides, leads and inspiring others to want to participate in the process of moving towards the vision.

3. Self awareness: It is the individual awareness of him or her self – their abilities and the impact that they have on others.

4. Acceptance of responsibility: True leaders are accepting responsibility for all that comes their way and taking ownership and responsibilities for getting things back on track. Blaming, justifying and excuse making just is not in their responsibility.

B. The **Experimental methodology** is designed for both teacher and student. The teacher can refer the experimental methodology for the details of equipment/apparatus/ materials/tools, procedure to be followed, observations to be made, graphs to be drawn and calculations to be done for the task to be performed

2. Student

The Worksheet is designed keeping in view the needs, deficiencies and the adolescent characteristics of the student for student.

The students submit the filled in work sheet given by the teacher on the day of experiment after referring to experimental methodology and listening to instructions of teacher. The design of the worksheet is made user friendly and the contents are so logically sequenced that the student finds it easy to understand and develop the skill of recording and report writing skill. It also helps the student to actively participate in skill learning. More importantly the student gets immediate meaningful feedback of his performance since the competency wise assessment is done and that too on the same day.

3. Examiner

The examiner may find this hand book very useful as Laboratory sheets and Scheme of evaluation provides information with regard to various competencies (skills) the students is expected to acquire during the course of study and the relative weightages of each competency. This information helps him to design a well balance question paper/measurement tool for assessment.

MEASUREMENT OF R, L AND C USING LCR METER

OBJECTIVE: To measure the resistance, inductance and capacitance values of given resistors, inductors and capacitors respectively using LCR meter.

APPARATUS REQUIRED: 1. LCR Meter-1No.
2. Resistors (assorted values) -3No
3. Capacitors (assorted values) -3No
4. Inductors (assorted values) -3No

2. TASK ANALYSIS:

A.   KNOWLEDGE

1. Calculation of the resistance value using color code

2. Finding the theoretical values of given capacitors using their marked values

3. Finding the theoretical values of given inductors using their marked values

4. Precautions.

B. SKILL

Handling of Apparatus	• Identifying various front panel controls of LCR meter. • Identifying the zero adjustment knob • Identifying the function selector switch. • Identifying the range selection switch • Identifying the values of given resistors, inductors and capacitors. • Selecting the correct probes for interconnection.
Manipulation of apparatus	• Sketch the front panel diagram. • Connecting the component under measurement to the input terminals of the LCR meter using appropriate probes. • Set the zero adjustment control. • Set the function selector to the appropriate measurement mode. • Set the range selectors to the appropriate range.
Precise operations/Activities	• Read the measured values of given resistor/inductor/capacitor. • Find the theoretical values of given resistor/inductor/capacitor. • Tabulate both theoretical and measured values of given resistor/inductor/capacitor. • Compare both theoretical and measured values of each component • Check whether the measured value of each component is lying within the tolerance limits.

2. TEACHING POINTS:

Sl No	Teaching Point	Suggested Time-15 min
1.	Resistors color code	1
2.	Reading the marked value of the Capacitor	1
3.	Reading the marked value of the Inductor	1
4.	Use of Digital LCR meter	1
5.	Functions of various controls of LCR meter	1
6.	Significance of zero adjustment control	1
7.	Selecting the appropriate function	1
8.	Selecting the appropriate range	2
9.	Procedure for measuring resistance, capacitance and inductance	2
10.	Tabulating and comparing the theoretical and measured values.	2
11.	Interpreting results.	1
12.	Precautions.	1

A. PROCEDURAL PRECAUTIONS:

- Disconnect all the equipment from mains before making connections.
- Setup the equipment as per the procedure.
- Get the connections checked by the concerned staff member.
- Ensure that there are no loose connections.
- Capacitor should be connecting with proper polarity.

B. SAFETY PRECAUTIONS:

- Never work on a circuit while power is applied.
- Do not connect power to a circuit until the circuit is finished and you have carefully checked your work.

- If you smell anything burning, immediately disconnect the power and examine your circuit to find out what went wrong.
- Keep your work area dry.

3. NEED AND SCOPE OF EXPERIMENT

This experiment is essential to measure the resistors, inductors and capacitors of unknown/known values and to check whether they are working or not. It can also be used to measure another three parameters ie, impedance Z, dissipation factor D and quality factor Q which can fulfill the measurement needs of various components manufacturers and maintenance technicians.

4. PLANNING AND ORGANISATION:

ACTION	ACTIVITY
Check for	- The resistors, capacitors and inductors. - LCR meter. - Connecting probes, power chords - LCR operating manual - The students entry behavior - First aid kit - Wires of Standard colors and Gauges
For Design of Instruction	Read teaching points carefully.

5. SCHEME OF EVALUATION:

CATEGORY OF SKILL	SUB TASK	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY					
1. Handling of apparatus	A). Identifying various terminals B) Using correct range of LCR meter. C) Setting the Potentiometer(POT) to correct values. D) Identification of capacitor, inductor and Resistor values. E) Identifying various front panel controls	A	B	C	D	E	T
		1	1	1	1	1	5
2. Manipulation of apparatus	A) Sketch the front panel diagram B) A. Setup the LCR meter to suitable settings for the measurement of R, L and C. C) Set the function selector and range to measure Resistance. D) Set the function selector and range to measure Inductance E) Set the function selector and range to measure Capacitance.	A	B	C	D	E	T
		5	5	3	1	1	15
3.Precise operations/Activities	A. Adjusting controls to fine tune the equipment for measurement of Resistance value B. Adjusting controls to fine tune the equipment for measurement of Capacitance value C. Adjusting zero controls to fine tune the equipment for measurement of Inductance value B. Calculation of theoretical values C. Compare measured values with theoretical values .	A	B	C	D	E	T
		5	5	5	5	5	25

4.Values	A. Co-operation. B. Co-ordination C. Communication D. Sharing E. leadership	5
	Total	50

ASSESSMENT / VIVA QUESTIONS:

1. Calculate the resistance value of a resistor which has the color bands red, red, red and gold.
2. What are the color bands of a resistor whose resistance value is 1kΩ±10%
3. Find the capacitance value of a disc capacitor whose value is marked as 102 on its body.
4. Why do we need zero adjustment in LCR meter?
5. For which type of capacitors the polarity of the terminals must be considered.
6. How can you measure the equivalent capacitance of two capacitors connected in parallel using LCR meter?
7. What are the parameters other than R, L, C that can be measured using LCR meter?
8. How do you identify the set range in LCR meter is not suitable while measuring?

DIGITAL IC TESTER

1. OBJECTIVE: To test an IC using Digital IC tester.

 REQUIREMENTS:

> **Digital IC Tester**
>
> **IC 7400**
>
> **IC 7408**
>
> **IC 7432**
>
> **IC 7436**

TASK ANALYSIS

> **A.   KNOWLEDGE**
>
>> 1. Knowing the IC number.
>>
>> 2. Procedure to enter IC number in the IC tester.
>>
>> 3. Knowing how to use IC tester.
>>
>> 4. Knowing the control keys on IC tester.

B. SKILL

Handling of Apparatus	A. Identifying the controls on IC tester. B. Identifying the display codes in IC tester. C. Using the IC tester. D. Placing the IC in ZIF socket
Manipulation of apparatus	A. Placing the IC in IC tester with proper orientation. B. Locking the IC using lever on IC tester. C. Using proper control keys. D. Observing the readings from display.
Precise operations/Activities	A. Reading the status of the IC. B. Recording the IC number from display. C. Checking all the pins of IC tester.
Values	A. Co-operation B. Co-ordination C. Communication D. Sharing E. Leadership

2. TEACHING POINTS

SI No	Teaching Points	Suggested Time-15 min
1.	IC number identification	2
2.	Insertion of IC into IC tester	2
3.	Entering the IC number in IC tester	3
4.	Function of keys on IC tester.	6
5.	Precautions	2

3. PRECAUTIONS:

A. Procedural precautions:
1. Ensure that the IC is inserted properly.
2. Don't apply pressure to insert IC in socket.
3. Lock the IC using lever.

B. Safety precautions:
1. The IC should be properly placed on IC tester.
2. .Handle the IC tester with care.

C. NEED AND SCOPE OF EXPERIMENT:
a) Used for IC testing.
b) Used to test IC for continuous operation (loop test).
c) Used to check all pins (1 to 39) of ZIF socket
d) Used to identify IC number.

4. Planning and organization:

Action	Activity
Check for	• Check the working condition of the Digital IC trainer kit. • The student entry behavior. • Availability of first aid kit.
For design of instruction	• Read the teaching points carefully.

5. SCHEME OF EVALUATION

CATEGORY OF SKILL	SUB TASK	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY					TOTAL (50)
1. Handling of apparatus	A. Identifying the controls on IC tester. B. Identifying the display codes in IC tester. C. Using the IC tester. D. Placing the IC in ZIF socket	A: 3	B: 2	C: 3	D: 2	T: **10**	
2. Manipulation of apparatus	A. Placing the IC in IC tester with proper orientation. B. Locking the IC using lever on IC tester. C. Using proper control keys. D. Observing the status from display.	A: 5	B: 2	C: 7	D: 6	T: **20**	
3.Precise operations/Activities	A. Reading the status of the IC. B. Recording the IC number from display. C. Checking all the pins of IC tester.	A: 5	B: 5	C: 5	T: **15**		

4.Values	A. Co Operation B. Co-Ordination C. Communication D. Sharing E. Leadership	T 5		
Total		**50**		

6. ASSESSMENT / VIVA QUESTIONS:

VIVA QUESTIONS:-

1. What are the functions of IC tester?
2. What are the keys present on IC tester?
3. What are the precautions to be followed while placing an IC in IC tester?
4. When do you get the message "FAIL" in display of IC tester?
5. How can you confirm an IC is in healthy condition?
6. When do you get the message "ERROR" in display of IC tester?
7. How can you identify the IC number using IC tester?
8. What is the full form of IC?
9. How do you enter the IC number for testing in an IC tester?

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DIGITAL FREQUENCY METER

Objective :

To measure frequency of a given signal using digital frequency meter

Apparatus required :

1. Digital frequency meter – 1No.
2. Function generator   - 1No.
3. Connecting wires

1. Task analysis:

A.   Knowledge
1. Working of function generator
2. Working of frequency meter
3. Precautions

B.   Skills

S.No	Category of skill	Subtask
1	Handling of apparatus	A. Identification of Components and its terminals B. Using correct range meters. C. Identifying any error in function generator
2	Manipulations of apparatus	A. Drawing the circuit diagram B. Selecting required components C. Making the connections as per the Circuit. D. Apply the different frequencies in function generator
3	Precise operations/activities	A. Measuring the output frequency corresponding to input signal. B. Recording the values of output and input frequencies
4	Values	A. Co-operation B. Co-ordination C. Communication D. Sharing E. Leadership

2.Teaching points :

S.No	Teaching point	Time allocation
1.	Operation of function generator	**5min**
2.	How to apply different frequencies	**3min**
3.	Principle of digital frequency meter	**2min**
4.	Operation of frequency meter	**5min**

3. Procedure

A. Procedural precautions

- Disconnect all the equipment from mains before making connections
- Connect the circuit as per the circuit diagram
- Ensure the correct range meters
- Check for polarity
- Get the connections checked by the concerned staff member
- Ensure that there are no loose connections
- Equipment should be handled carefully

B. Safety precautions

- Never make connections on a circuit when supply is in ON position.
- If you smell anything burning , immediately disconnect the power and examine your circuit to find out what went wrong.
- Keep your work area dry.
- Always wear safety goggles.

4. Need & Scope :

- Measuring the frequency of an oscillator in a circuit
- Signal on a line.
- Any application where the frequency of a steady repetitive signal needs to be measured.
- For testing radio equipment, measuring   vibration, strain.

5. PLANNING AND ORGANISATION:

ACTION	ACTIVITY
Check for	- The frequency meter. - Function generator. - The students entry behavior - First aid kit - Wires of Standard colours and Gauges
For Design of Instruction	Read teaching points carefully.

6. Scheme of evaluation:

Category of skill	Subtask	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY	TOTAL
Handling apparatus	A. Identification of Components and its terminals B. Using correct range meters. C. Identifying any error in function generator	<table><tr><td>A</td><td>B</td><td>C</td><td>T</td></tr><tr><td>2</td><td>2</td><td>1</td><td>5</td></tr></table>	5
Manipulations of apparatus	A. Drawing the circuit diagram B. Selecting required components C. Making the connections as per the Circuit. D. Apply the different frequencies in function generator	<table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>T</td></tr><tr><td>5</td><td>2</td><td>3</td><td>5</td><td>15</td></tr></table>	15
Precise operations/activities	A. Measuring the output frequency corresponding to input signal. B. Recording the values of output and input frequencies	<table><tr><td>A</td><td>B</td><td>T</td></tr><tr><td>15</td><td>10</td><td>25</td></tr></table>	25
Values	A. Co-operation B. Co-ordination C. Communication D. Sharing E. Leadership	<table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>T</td></tr><tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>5</td></tr></table>	5
		Total	50

7. ASSESSMENT / VIVA QUESTIONS:

1. What is frequency?

2. Why we use Schmitt trigger in frequency meter?

3. What is the unit of frequency?

4. What is the relation between frequency and time?

5. What is the purpose of AND gate in frequency meter?

Verification of Series Resonance

Aim: (a) Connect Series RLC circuit and verify the Series Resonance.

Equipment required:

The setup for this experiment requires the following equipment

S.No	Name of the Apparatus	Type	Range	Quantity
1	Function Generator	-		1 No
2	Ammeter	MI	0-10 mA	1 No
3	Voltmeter or Digital Multimeter	MI	0-10V	1 No
4	**Resistor**	Carbon	1KΩ	1 No
5	DC**B**			1 No
6	DIB			1 No
7	Bread Board			1 No
8	Connecting wires	-	-	Required No

1. Task analysis:

 A. Knowledge
1. Setting of values on DIB and DCB
2. Function generator settings
3. Condition for Series Resonance
4. Expression for the series resonant frequency.
5. Identification of the terminals, type and range of ammeter.

B. Skill

Handling of Apparatus	A. Identification of components.
	B. Setting of values on DIB and DCB
	C. Selecting correct range of Ammeter.
	D. Selecting the correct type of ammeter
	E. Proper handling of the function generator

Manipulation of apparatus	A. Drawing the circuit diagram. B. Making the connections as per the circuit diagram. C. Switching on the supply to the function generator. D. Setting the input source voltage at a constant voltage E. Observing the readings in ammeter
Precise operations/Activities	A. Measuring the ac input voltage B. Recording the readings of ammeter by varying the frequency in steps of ------- Ex:1Khz. Tabulating the readings. C. Plotting the curve between frequency and current D. Observing the frequency at which maximum current flows through the circuit. E. Verifying the occurrence of series resonance

2. Teaching points

Sl No	Teaching Point	Suggested Time-
1.	Explaining the concept of series resonance	3
2.	Connecting the circuit as per the circuit diagram	1
3.	Applying required input voltage from function generator by varying the voltage control knob	1
4.	Setting the inductance value in the DLB as per the requirement	1
5.	Setting the capacitance value in the DCB as per the requirement	1
6.	Taking readings from the ammeter at different frequencies	1
7.	Calculation of theoretical value of resonance frequency	1
8.	Tabulating and comparing the theoretical and measured values.	1
9.	Plotting the graph taking frequency on x-axis and current on y-axis	2
10.	Determining the frequency at which resonance occurred from the graph and Interpreting results	2
11.	Precautions.	1

A. Procedural precautions

- Initially keep the function generator output voltage knob in zero volt position
- If the pointer in ammeter is not in zero position, set the pointer at zero position.
- Take the readings without parallax error.
- Avoid loose connections.
- Avoid short circuit of RPS output terminals.

B. Safety precautions :

- Disconnect all the equipment from mains before making connections

- Setup the equipment as per the procedure

- Get the connections checked by the concerned staff member

- Ensure that there are no loose connections

3**. Need and scope of Experiment**

The high value of current at resonance produces very high values of voltage across the inductor

and capacitor. Series resonance circuits are useful for constructing **highly frequency selective filters**.

Because impedance is minimum and current is maximum, series resonance circuits are also called

Acceptor Circuits. A series resonant circuit **provides voltage magnification**

4. **Planning and organization**

Action	Activity
Check for	- Ammeter, voltmeter of correct type, range - Decade Capacitance Box and Decade Inductance Box. - Check for Function generator - Connecting wires - The students entry behavior
For Design of Instruction	Read teaching points carefully

5. **Scheme of Evaluation**

Category of skill	Subtask	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY	MARKS AWARDED
Handling apparatus	A. Identification of components. B. Setting of values on DLB and DCB C. Selecting correct range of Ammeter. D. Selecting the correct type of ammeter E. Proper handling of the function generator	<table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>T</td></tr><tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>5</td></tr></table>	
Manipulations of apparatus	A. Drawing the circuit diagram. B. Making the connections as per the circuit diagram. C. Switching on the supply to the function generator.. D. Setting the input source voltage at a constant voltage E. Observing the readings in ammeter	<table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>T</td></tr><tr><td>5</td><td>5</td><td>2</td><td>1</td><td>2</td><td>15</td></tr></table>	
Precise operations/activities	A. Measuring the ac input voltage B. Recording the readings of ammeter by varying the frequency in steps of 1Khz. Tabulating the readings. C. Plotting the curve between frequency and current D. Observing the frequency at which maximum current flows through the circuit. E. Verifying the occurrence of series resonance	<table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>T</td></tr><tr><td>5</td><td>5</td><td>5</td><td>5</td><td>5</td><td>25</td></tr></table>	
Values	A. Co-operation B. Co-ordination C. Communication D. Sharing E. Leadership	5	
		TOTAL	50

6. Assessment / Viva questions

1. What is the condition for resonance for an RLC series circuit?

2. How the RLC series circuit behaves for the frequencies above the resonant frequency?

3. How the RLC series circuit behaves for the frequencies below the resonant frequency?

4. How does the series resonant circuit behave under resonance?

5. Why current is maximum at series resonance?

Verification of Parallel Resonance

Aim: (a) Connect Series RLC circuit and verify the Parallel Resonance.

Equipment required:

The setup for this experiment requires the following equipment

S.No	Name of the Apparatus	Type	Range	Quantity
1	Function Generator	-		1 No
2	Ammeter	MI	0-10 mA	1 No
3	Voltmeter or Digital Multimeter	MI	0-10V	1 No
4	**Resistor**	Carbon	1KΩ	1 No
5	DC**B**			1 No
6	DIB			1 No
7	Bread Board			1 No
	Connecting wires	-	-	Required No

1. Task analysis:

 A. Knowledge
1.   Setting of values on DIB and DCB
2.   Function generator settings
3.   Condition for Parallel Resonance
4.   Expression for the Parallel resonant frequency.
5.   Identification of the terminals, type and range of ammeter.

B. Skill

Handling of Apparatus	A. Identification of components. B. Setting of values on DIB and DCB C. Selecting correct range of Ammeter. D. Selecting the correct type of ammeter E. Proper handling of the function generator
Manipulation of apparatus	A. Drawing the circuit diagram. B. Making the connections as per the circuit diagram. C. Switching on the supply to the function generator.. D. Setting the input source voltage at a constant voltage E. Observing the readings in ammeter

Precise operations/Activities	A. Measuring the ac input voltage B. Recording the readings of ammeter by varying the frequency in steps of ------- Ex:1Khz. Tabulating the readings. C. Plotting the curve between frequency and current D. Observing the frequency at which maximum current flows through the circuit. E. Verifying the occurrence of parallel resonance

2. Teaching points

Sl No	Teaching Point	Suggested Time-15
1.	Explaining the concept of parallel resonance	3
2.	Connecting the circuit as per the circuit diagram	1
3.	Applying required input voltage from function generator by varying the voltage control knob	1
4.	Setting the inductance value in the DIB as per the requirement	1
5.	Setting the capacitance value in the DCB as per the requirement	1
6.	Taking readings from the ammeter at different frequencies	1
7.	Calculation of theoretical value of resonance frequency	1
8.	Tabulating and comparing the theoretical and measured values.	1
9.	Plotting the graph taking frequency on x-axis and current on y-axis	2
10.	Determining the frequency at which resonance occurred from the graph and Interpreting results	2
11.	Precautions.	1

A. Procedural precautions

- Initially keep the function generator output voltage knob in zero volt position
- If the pointer in ammeter is not in zero position, set the pointer at zero position.
- Take the readings without parallax error.
- Avoid loose connections.
- Avoid short circuit of RPS output terminals.

B. Safety precautions :

- Disconnect all the equipment from mains before making connections

- Setup the equipment as per the procedure

- Get the connections checked by the concerned staff member

- Ensure that there are no loose connections

3**. Need and scope of Experiment**

A parallel resonant circuit provides current magnification. A parallel resonant circuit can be used as load impedance in output circuits of RF amplifiers. Due to high impedance, the gain of amplifier is maximum at resonant frequency.

Parallel resonant circuits are generally used in a shunt configuration to allow a desired signal to pass by acting as a very high shunt impedance, but to act as a very low impedance for others therefore effectively shorting them out. This effect is most useful for tuning a radio, where the desired signal is allowed to pass through to the next stage in the radio, without allowing other signals to get through as they are effectively shorted out before reaching the rest of the radio circuitry.

4. **Planning and organization**

Action	Activity
Check for	- Ammeter, voltmeter of correct type, range - Decade Capacitance Box and Decade Inductance Box. - Check for Function generator - Connecting wires - The students entry behavior
For Design of Instruction	Read teaching points carefully

5. **Scheme of Evaluation**

Category of skill	Subtask	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY	MARKS AWARDED
Handling apparatus	A. Identification of components. B. Setting of values on DLB and DCB C. Selecting correct range of Ammeter. D. Selecting the correct type of ammeter E. Proper handling of the function generator	<table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>T</td></tr><tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>5</td></tr></table>	
Manipulations of apparatus	A. Drawing the circuit diagram. B. Making the connections as per the circuit diagram. C. Switching on the supply to the function generator.. D. Setting the input source voltage at a constant voltage E. Observing the readings in ammeter	<table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>T</td></tr><tr><td>5</td><td>5</td><td>2</td><td>1</td><td>2</td><td>15</td></tr></table>	
Precise operations/activities	A. Measuring the ac input voltage B. Recording the readings of ammeter by varying the frequency in steps of---- Ex: 1Khz. Tabulating the readings. C. Plotting the curve between frequency and current D. Observing the frequency at which maximum current flows through the circuit. E. Verifying the occurrence of parallel resonance	<table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>T</td></tr><tr><td>5</td><td>5</td><td>5</td><td>5</td><td>5</td><td>25</td></tr></table>	
Values	A. Co-operation B. Co-ordination C. Communication D. Sharing E. Leadership	5	
		TOTAL	50

6. Assessment / Viva questions

    1.   What is the condition for resonance for an RLC series circuit?

    2.   How the parallel RLC circuit behaves for the frequencies above the resonant frequency?

    3.   How the parallel RLC circuit behaves for the frequencies below the resonant frequency?

    4.   How does the parallel resonant circuit behave under resonance?

    5.   Why current is minimum at parallel resonance?

Thevenin's theorem

Objective: To verify Thevenin's theorem for the given DC circuit.

Apparatus:

S.No	Name of the Apparatus	Type	Range	Quantity
1.	Regulated Power Supply (RPS)	-	0-30 V	1 No
2.	Voltmeter	MC	0-10 V	1 No
3.	Ammeter	MC	0-10 mA	1 No
4.	Resistors	Carbon composition	2.2 k Ω , 100 Ω 1 k Ω	Each one No. Each two No.
5.	Decade resistance box	-	0-1 k Ω	1 No
6.	Bread Board	-	-	1 No
7.	Connecting wires	-	-	Required No

Task Analysis

A. Knowledge

1. Statement of Thevenin's theorem
2. Principle of KVL and KCL
3. Network reduction techniques
4. Properties of open circuit and short circuit

B. Skill

Handling of Apparatus	• Drawing the circuit diagram • Identifying various terminals • Using correct range ammeter and voltmeter
Manipulation of apparatus	• Making the connections • Checking the connections • Switching on the supply • Observe the reading in ammeter • Handling the RPS
Precise operation / Activities	• Measure the current flows in the load resistor R_L • Note down the Thevenin's equivalent voltage • Calculate the Thevenin's equivalent resistance. • Note down the current flows in the load resistor using Thevenin's equivalent circuit. • Compare theoretical with practical values.

2. Teaching points

S. No	Teaching point	Suggested time – min
1	Different network theorems	10 min
2	Uses of Thevenin's theorem	
3	Theoretical calculations	
4	RPS – Different terminals	5 min
5	Thevenin's theorem circuit arrangement	
6	Limitations of Thevenin's theorem	
7	Compare theoretical with practical values	5 min
8	Precautions	

A. Procedural precautions

- Initially keep the RPS output voltage knob in zero volt position.
- Set the ammeter pointer at zero position.
- Take the readings without parallax error.
- Avoid loose connections

B. Safety precautions:

- Shoes must be won at all times.
- Never touch any electrical appliances with wet hands.

3**. Need and scope of Experiment**

4. **Planning and organization**

| Action	Activity
Check for	• Meters and resistors • The students entry behavior • Check the connectivity in the probes
For Design of Instruction	• Read teaching points carefully

5. **Scheme of Evaluation**

CATEGORY OF SKILL	SUB TASK	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY	TOTAL
1. Handling of apparatus	A. Drawing circuit diagram and identifying various terminals B. Using correct range of ammeter	<table><tr><td>A</td><td>B</td><td>T</td></tr><tr><td>5</td><td>5</td><td>10</td></tr></table>	
2. Manipulation of apparatus	A. Setup the RPS to suitable voltages.	10	
3. Precise operations / Activities	A. Recording the readings in Ammeter B. Calculation of theoretical values C. Compare practical with theoretical values	<table><tr><td>A</td><td>B</td><td>C</td><td>T</td></tr><tr><td>5</td><td>15</td><td>5</td><td>25</td></tr></table>	
4. Values	A. Cooperation B. Coordination C. Communication D. Sharing E. Leadership	5	
	Total	50	

6. Assessment / Viva questions

(1) How do you find the open circuit voltage?

(2) How do you find the Thevenin's equivalent resistance?

(3) How voltage source can be replaced while finding the value of R_{Th}.

(4) How current source can be replaced while finding the value of R_{Th}.

(5) Draw the equivalent circuit of Thevenin's theorem.

(6) Can we use Moving iron instruments in DC circuits.

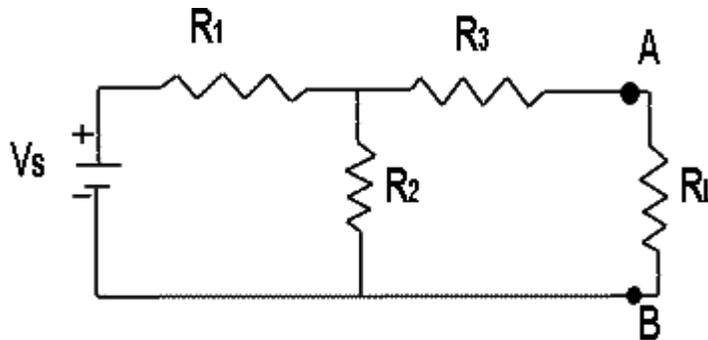(7) List any two differences in MI and MC instruments?

7. Exercise questions

1. (a) Draw the circuit diagram of a Thevenin's theorem.

   (b) Calculate the value of load current theoretically for the given circuit parameters by using Thevenin's theorem.

   (c) Verify the Thevenin's theorem for given circuit parameters and compare the practical values with theoretical values.

2. (a) Identify the various terminals and knobs in a RPS and also set the RPS to the given voltage.

 (b) Make the connection for the Thevenin's theorem according to circuit diagram for calculating the load current.

(c) Verify the Thevenin's theorem for the given circuit parameters and compare the practical values with theoretical values.
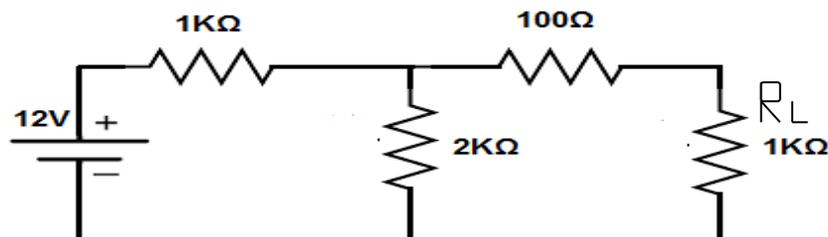
3.(a) Identify the required resistors for conducting Thevenin's theorem by using colour code

(b Make the connection for the Thevenin's theorem according to circuit diagram for calculating the V_{th} and R_{th}

(c) Verify the Thevenin's theorem for the given circuit parameters and compare the practical values with theoretical values.

Verification of superposition theorem

Objective   :   To verify superposition theorem for the given D.C circuit.

Apparatus:

S.No	Name of the Apparatus	Type	Range	Quantity
1	Regulated Power Supply (RPS)	-	0-30 V	1 No
2	Ammeter	MC	0-10 mA	1 No
3	Resistors	Carbon composition	4.7 k Ω , 1.8 k Ω and 1 k Ω	Each one No
4	Bread board	-	-	1 No
5	Connecting wires	-	-	Required No

1. Task analysis:

 A. Knowledge

   1. Statement of superposition theorem

   2. Principle of KVL and KCL

   3. Network reduction techniques

   4. Properties of open circuit and short circuit

B. Skill

Handling of Apparatus	• Drawing the circuit diagram • Identifying various terminals • Using correct range ammeter and voltmeter
Manipulation of apparatus	• Making the connections • Checking the connections • Switching on the supply • Observe the reading in ammeter • Handling the RPS
Precise operation / Activities	• Adjusting the source voltages of V_1 and V_2 to 20V and 5V respectively . • Note down the reading of ammeter (I_L) in Fig.1.1 • Now set the voltage source 'X' to 20 V and source 'Y' to 0 V. • Note down the ammeter reading (current, I_L). • Now set the voltage source 'Y' to 5 V and source 'X' to 0 V. • Note down the corresponding ammeter reading (current,(I_L)). • Compare the practical values with theoretical values.

2. Teaching points

S. No	Teaching point	Suggested time – min
1	Different network theorems	
2	Uses of superposition theorem	10 min
3	Theoretical calculations	
4	RPS – Different terminals	
5	Superposition theorem circuit arrangement	5 min
6	Limitations of superposition theorem	
7	Compare theoretical with practical values	5 min
8	Precautions	

A. Procedural precautions

- Initially keep the RPS output voltage knob in zero volt position.

- Set the ammeter pointer at zero position.

- Take the readings without parallox error.

- Avoid loose connections.

B. Safety precautions:

3. **Need and scope of Experiment**

4. **Planning and organization**

Action	Activity
Check for	- Meters and resistors - The students entry behavior - Check the connectivity in the probes
For Design of Instruction	Read teaching points carefully

5. **Scheme of Evaluation**

CATEGORY OF SKILL	SUB TASK	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY	TOTAL
1. Handling of apparatus	A. Drawing circuit diagram and identifying various terminals B. Using correct range of ammeter	<table><tr><td>A</td><td>B</td><td>T</td></tr><tr><td>5</td><td>5</td><td>10</td></tr></table>	
2. Manipulation of apparatus	A. Setup the RPS to suitable voltages.	10	
3. Precise operations / Activities	A. Recording the readings in Ammeter B. Calculation of theoretical values C. Compare practical with theoretical values	<table><tr><td>A</td><td>B</td><td>C</td><td>T</td></tr><tr><td>5</td><td>15</td><td>5</td><td>25</td></tr></table>	
4. Values	A. Cooperation B. Coordination C. Communication D. Sharing E. Leadership	5	
	Total	50	

6. Assessment / Viva questions

(i)   What do you mean by the term linear ?

(ii) Can the superposition theorem be applied to determine 'power' in an element of a circuit ?

(iii) Under what conditions is the superposition theorem applicable ?

(iv) What do you mean by Parallax error ?

(v)   Is there any difference between MI and MC instruments ?

(vi) What is the function of R.P.S?

7. Exercise Questions:

1 .(a) Draw the Circuit diagram of Superposition Theorem for the given circuit.

   (b) Identify the required Resistors (4.7 k Ω ,1.8kΩ   ,1k Ω) for conducting Superposition Theorem using the colour code.

   (c) Calculate Theoretical values of the Load Current (I_L) for the given circuit using Superposition Theorem.

2 (a) Identify the Various terminals of   R.P.S

   (b) Make the connections as per the circuit diagram for conducting superposition theorem.

   (c) Compare Theoretical values with Practical values for the given parameters of the Superposition theorem.

3 (a) Choose correct range of Ammeter (0-10mA, MC) for the given circuit.

  (b) Set up the R.P.S to suitable Voltage values (20V, 5V) for the given circuit.

 (c) Verify SuperPosition Theorem for given Circuit parameters .

Circuit Globe
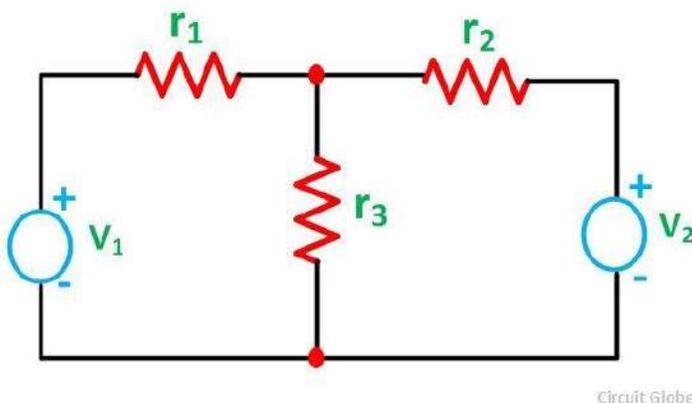
Verification of Maximum Power Transfer Theorem

Objective: To verify Maximum power Transfer Theorem

Equipment required:

The setup for this experiment requires the following equipment

S.No	Name of the Apparatus	Type	Range	Quantity
1	Regulated Power Supply (RPS)	-	0-30 V	1 No
2	Ammeter	MC	0-10 mA	1 No
3	Resistors	Wire wound	1 k Ω	1No.
4	DRB	-	-	1 No
5	Connecting wires	-	-	Required No

1. Task analysis:

A. Knowledge
1. Statement of Maximum Power transfer Theorem
2. Formula for power delivered to the load resistor
3. Calculation of power delivered to load.
4. Identification of Resistor values
5. Identification of the terminals, type and range of ammeter.

B. Skill

Handling of Apparatus	• Identification of components. • Identifying terminals of the DRB and its each dial range • Selecting correct range of Ammeter. • Selecting the correct type of ammeter • Proper handling of the RPS
Manipulation of apparatus	• Drawing the circuit diagram. • Make the connections as per the circuit diagram. • Switching on the supply to and RPS.

	• Observing the readings in voltmeter • Setting the input source voltage at a constant voltage
Precise operations/Activities	• Recording the readings of ammeter by varying the load resistance (DRB) in steps of 200Ω. Tabulating the values • Calculating the power delivered to load resistor in each step. • Plotting the load resistance versus power delivered graph. • Finding the load resistance at which maximum power is transferred. • Verifying the maximum power transfer theorem.

2. Teaching points

Sl No	Teaching Point	Suggested Time-
1.	Stating of maximum power transfer theorem and its importance	1
2.	Connecting the circuit as per the circuit diagram	1
3.	Applying required input voltage from RPS by varying the voltage control knob	1
4.	Setting the resistance in the DRB as per the requirement	1
5.	Taking readings from the ammeter at different load resistances	1
6.	Calculation of theoretical value of maximum power delivered to load	1
7.	Tabulating and comparing the theoretical and measured values.	1
8.	Plotting the graph taking load resistance on x-axis and power delivered to load on y-axis	2
9.	Determining the load resistance at which maximum power is delivered from the graph and Interpreting results	2
10.	Limitations of maximum power transfer theorem	2
11.	Precautions.	2

A. Procedural precautions

- Initially keep the RPS output voltage knob in zero volt position and current setting knob at middle position.
- If the pointer in ammeter is not in zero position, set the pointer at zero position.
- Take the readings without parallax error.
- Avoid loose connections.
- Avoid short circuit of RPS output terminals.

B. Safety precautions :
- Disconnect all the equipment from mains before making connections
- Setup the equipment as per the procedure
- Get the connections checked by the concerned staff member
- Ensure that there are no loose connections

3**. Need and scope of Experiment**

      Maximum power transfer theorem is very much needed while cascading different sections of any circuit. In PA systems the resistance of loud speaker must selected such that its resistance is equal to amplifier's output resistance.

      The maximum power transfer theorem can be extended to AC circuits having AC sources and impedances. In this case maximum power will be delivered from ac source to load when the load impedance is complex conjugate of source impedance.

4. **Planning and organization**

Action	Activity
Check for	- Ammeter of correct type, range - Decade Resistance Box - Check for regulated power Supply - Connecting wires - The students entry behavior
For Design of Instruction	Read teaching points carefully

5. **Scheme of Evaluation**

Category of skill	Subtask	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY	MARKS AWARDED
Handling apparatus	A. Identification of components. B. Identifying terminals of the DRB and its each dial range C. Selecting correct range of Ammeter. D. Selecting the correct type of ammeter E. Proper handling of the RPS	<table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>T</td></tr><tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>5</td></tr></table>	
Manipulations of apparatus	A. Drawing the circuit diagram. B. Make the connections as per the circuit diagram. C. Switching on the supply to and RPS. D. Observing the readings in ammeter E. Setting the input source voltage at a constant voltage	<table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>T</td></tr><tr><td>5</td><td>5</td><td>3</td><td>1</td><td>1</td><td>15</td></tr></table>	
Precise operations/activities	A. Recording the readings of ammeter by varying the load resistance (DRB) in steps of 200Ω. Tabulating the values B. Calculating the power delivered to load resistor in each step. C. Plotting the load resistance versus power delivered graph. D. Finding the load resistance at which maximum power is transferred. E. Verifying the maximum power transfer theorem.	<table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>T</td></tr><tr><td>5</td><td>5</td><td>5</td><td>5</td><td>5</td><td>25</td></tr></table>	
Values	• Co-operation • Co-ordination • Communication • Sharing • Leadership	5	
		TOTAL	50

6. Assessment / Viva questions

  I. What do you mean by the term linear ?

  II. What do you mean by Parallax error ?

  III. Is there any difference between MI and MC instruments ?

  IV. What is the function of R.P.S ?

  V. As per the Maximum power transfer theorem at what point does maximum load power occur?

Measurement of AC and DC Voltages using CRO

Objective: To measure AC and DC voltages using CRO.

Apparatus:

1. CRO 0 to 20 MHz (Dual Channel)   -1 No
2. Bread board   -1 No
3. Function Generator (1Hz-1MHz).   -1 No
4. Regulated power supply (0-30V)   -1 No
5. Connecting wires   - as per the need

1. Task analysis

A. Knowledge

    1. Basics of CRO.

    2. Basics of RPS

    3. Wave shaping by Transmission through Function generator and RPS

B. Skill

CATEGORY OF SKILL	SUB TASK
Handling of Apparatus	A. Identifying various pins and control panels on CRO, function generator and RPS. B. Making correct setting on CRO to get stable waveforms. C. Varying the frequency and amplitude knobs on CRO. D. Select the amplitude and frequency on function generator. E. Select the amplitude from RPS
Manipulation of apparatus	A. Making the Circuit connections. B. Checking the connections. C. Generating the sine wave from function generator D. Apply required DC voltage from RPS E. Setting of CRO in dual mode
Precise operations/Activities	A. Observing the sine wave by changing the amplitude and time period. B. Measuring the amplitude and time period from the wave forms on CRO and calculate the frequency C. Observing the DC signals by changing the amplitude. D. Measuring the amplitude for DC signal on CRO E. Drawing the waveforms and showing the salient features.

2. Teaching points:

Sl No	Teaching Point	Time allocation (Suggestive) 15min
1	CRO settings	5
2	Function generator settings	2
3	RPS settings	1
4	Time period and Frequency calculations	4
5	Amplitude calculation	2
6.	Precautions	1

A. Procedural precautions.

1. Disconnect all the equipment from mains before making connections.
2. Ensure the settings in CRO; Function Generator and RPS are CORRECT
3. Get the connections checked by the concerned staff member.
4. Ensure that there are no loose connections.
5. Ensure whether the CRO is calibrated.

B. Safety precautions.

1. Care must be taken while operating the equipment.
2. Wear shoes for the lab.

3. Need and scope of experiment.

CRO is a general purpose laboratory instrument for the provides accurate time and amplitude measurements of voltage signals over a wide range of frequencies.

4. Planning and organization:

Action	Activity
Check for	➢ CRO with probes, Function generator and RPS. ➢ Connecting wires ➢ The student entry behavior. ➢ Availability of first aid kit
For design of instruction	❖ Read the teaching points carefully.

5. Scheme of Evaluation:

SKILL	SUB TASK	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY						TOTAL
1.Handling of Apparatus	A. Identifying various pins and control panels on CRO, function generator and RPS. B. Making correct setting on CRO to get stable waveforms. C. Varying the frequency and amplitude knobs on CRO. D. Select the amplitude and frequency on function generator. E. Select the amplitude from RPS	**A**	**B**	**C**	**D**	**E**	**T**	
		1	1	1	1	1	5	
2.Manipulation of apparatus	A. Making the Circuit connections. B. Checking the connections. C. Generating the sine wave from function generator D. Apply required DC voltage from RPS E. Setting of CRO in dual mode	**A**	**B**	**C**	**D**	**E**	**T**	
		5	1	6	2	1	15	

3.Precise operations /Activities	A. Observing the sine wave by changing the amplitude and time period. B. Measuring the amplitude and time period from the wave forms on CRO and calculate the frequency C. Observing the DC signals by changing the amplitude. D. Measuring the amplitude for DC signal on CRO E. Drawing the waveforms and showing the salient features.	A	B	C	D	E	T	
		6	7	2	3	7	25	
4.values	A. Co Operation B. Co-Ordination C. Communication D. Sharing E .Leadership	T						
		5						
TOTAL		**50**						

6. Assessment / Viva Questions:

1. List the measurement devices?

2. What are the front panel controls of CRO?

3. What is the frequency of DC signal?

4. How to measure the frequency by knowing the time period

5. What is the relation between RMS value and Maximum value.

Measurement of **Pulse parameters using CRO**

Objective: To measure Pulse parameters using CRO.

Apparatus:

1. CRO 0 to 20 MHz (Dual Channel)   -1 No
2. CRO probe   -1 No
3. Pulse Generator (1Hz-1MHz).   -1 No
4. Connecting wires   - as per the need

1. Task analysis

A.Knowledge

1. Operation and different functions of CRO and pulse generator.

2. Concept of pulse width, pulse amplitude and duty cycle.

3. Basics of rise time and fall time

B. Skill

CATEGORY OF SKILL	SUB TASK
Handling of Apparatus	A. Identifying various pins and control panel on CRO and pulse generator. B. Making correct setting on CRO to get stable waveforms. C. Varying the frequency and amplitude knobs on CRO. D. Select the amplitude and frequency on pulse generator
Manipulation of apparatus	A. Making the Circuit connections. B. Checking the connections. C. Generating the pulse wave from pulse generator D. Setting of CRO in dual mode
Precise operations/Activities	A. Observing the pulse wave by changing the amplitude and time period. B. Measuring the amplitude, time period, rise time and fall time from the wave forms on CRO and calculate the frequency. C. Calculate pulse width and duty cycle from observed wave forms D. Drawing the waveforms and showing the salient features.

2. Teaching points:

Sl No	Teaching Point	Time allocation (Suggestive) 15min
1	CRO settings	3
2	Pulse generator settings	2
3	Pulse width and pulse amplitude	5
4	Time period, Frequency and duty cycle calculations	3
5	Amplitude calculation	1
6.	Precautions	1

A. Procedural precautions.

1. Disconnect all the equipment from mains before making connections.
2. Ensure the settings in CRO and Pulse Generator are CORRECT
3. Get the connections checked by the concerned staff member.
4. Ensure that there are no loose connections.
5. Ensure whether the CRO is calibrated.

B. Safety precautions.

1. Care must be taken while operating the equipment.
2. Wear shoes for the lab.

3. Need and scope of experiment.

Measuring speed of RADARS. Defense application, medical application,

4. Planning and organization:

Action	Activity
Check for	➢ CRO with probes and Pulse generator ➢ Connecting wires ➢ The student entry behavior. ➢ Availability of first aid kit
For design of instruction	❖ Read the teaching points carefully.

5. Scheme of Evaluation:

SKILL	SUB TASK	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY					TOTAL
1.Handling of Apparatus	A. Identifying various pins and control panels on CRO and function generator. B. Making correct setting on CRO to get stable waveforms. C. Varying the frequency and amplitude knobs on CRO. D. Select the amplitude and frequency on pulse generator	**A** 2	**B** 1	**C** 1	**D** 1	**T** 5	
2.Manipulation of apparatus	A. Making the Circuit connections. B. Checking the connections. C. Generating the pulse wave from pulse generator D. Setting of CRO in dual mode	**A** 5	**B** 2	**C** 6	**D** 2	**T** 15	
3.Precise operations/ Activities	A. Observing the pulse wave by changing the amplitude and time period. B. Measuring the amplitude, time period, rise time and fall time from the wave forms on CRO and calculate the frequency. C. Calculate pulse width and duty cycle from observed wave forms D. Drawing the waveforms and showing the salient features.	**A** 7	**B** 8	**C** 6	**D** 4	**T** 25	
4.values	A. Co Operation B. Co-Ordination C. Communication D. Sharing E. Leadership					**T** 5	
	TOTAL					**50**	

6. Assessment / Viva Questions:

1. Identify different parameters of pulse signal.

2. How to measure width and amplitude of pulse?

2. What are the front panel controls of CRO and pulse generator?

3. How to measure duty cycle?

4. What is rise time and fall time?

5. What is the pulse repletion frequency?

Measure frequency of Unknown signals using Lissajous patterns on CRO

Objective: To measure AC and DC voltages using CRO.

Apparatus:

1. CRO 0 to 20 MHz (Dual Channel)   -1 No
2. CRO probe   -1 No
3. Function Generator (1Hz-1MHz).   -2 No
4. Connecting wires   - as per the need

1. Task analysis

A.Knowledge

1. Operation and front panel controls of CRO and function generator.

2. Lissajous pattern concept.

3. Measuring of unknown frequency using lissajous patterns.

4. Vertical tangents and horizontal tangents

B. Skill

CATEGORY OF SKILL	SUB TASK
Handling of Apparatus	A. Identifying various pins and control panels on CRO and function generator B. Making correct setting on CRO to get stable waveforms. C. Varying the frequency and amplitude knobs on CRO. D. Select the amplitude and frequency for known and unknown signals from function generators.
Manipulation of apparatus	. A. Making the Circuit connections. A. Checking the connections. B. Generating the known and unknown sine waves from function generators C. Setting of CRO in X-Y mode D. Connect known signal and unknown signal to CRO
Precise operations/Activities	A. Generate Lissajous patterns by adjusting the voltage/div and time/div knobs on CRO. B. Measure number of horizontal and vertical tangents. C. Calculate unknown frequency D. Drawing the waveforms and showing the salient features.

2.Teaching points:

Sl No	Teaching Point	Time allocation (Suggestive) 15min
1	CRO settings	3
2	Function generator settings	2
3	Lissajous pattern concept	5
4	No. of horizontal and vertical tangents	2
5	Unknown frequency calculation	2
6.	Precautions	1

A. Procedural precautions.

1. Disconnect all the equipment from mains before making connections.
2. Ensure the settings in CRO; Function Generator and RPS are Correct.
3. Get the connections checked by the concerned staff member.
4. Ensure that there are no loose connections.
5. Ensure whether the CRO is calibrated.

B. Safety precautions.

1. Care must be taken while operating the equipment.
2. Wear shoes for the lab.

3. Need and scope of experiment.

1. Used to compare two different electrical signals
2. A known reference signal and a signal to be tested.
3. Verifying audio oscillator with a known-frequency signal.
4. Monitoring audio amplifiers and feedback networks for phase shift.

4. Planning and organization:

Action	Activity
Check for	➢ CRO with probes and Function generator ➢ Connecting wires ➢ The student entry behavior. ➢ Availability of first aid kit
For design of instruction	❖ Read the teaching points carefully.

5. Scheme of Evaluation:

SKILL	SUB TASK	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY						TOTAL
1.Handling of Apparatus	A. Identifying various pins and control panels on CRO and function generator B. Making correct setting on CRO to get stable waveforms. C. Varying the frequency and amplitude knobs on CRO. D. Select the amplitude and frequency for known and unknown signals from function generators.	**A** 1	**B** 1	**C** 1	**D** 2	**T** 5		
2.Manipulation of apparatus	A. Making the Circuit connections. B. Checking the connections. C. Generating the known and unknown sine waves from function generators D. Setting of CRO in X-Y mode	**A** 5	**B** 2	**C** 4	**D** 1	**E** 3	**T** 15	

	E. Connect known signal and unknown signal to CRO							
3.Precise operations/ Activities	A. Generate Lissajous patterns by adjusting the voltage/div and time/div knobs on CRO. B. Measure number of horizontal and vertical tangents. C. Calculate unknown frequency D. Drawing the waveforms and showing the salient features.	**A** 8	**B** 4	**C** 6	**D** 7	**T** 25		
4.values	A. Co Operation B. Co-Ordination C. Communication D. Sharing E .Leadership	**T** 5						
	TOTAL			**50**				

6. **Assessment / Viva Questions**:

1. What are the front panel controls of CRO?

2. How lissajous patterns are displayed?

3. What is the use of Lissajous pattern?

4. How do you find the frequency of a Lissajous pattern?

5. What figure appear if the phase difference between the signals applied is 0 degree?

PA System

Objective: To arrange PA system.

Apparatus:

1. Microphones   -2 Nos
2. Loud Speakers   -2 Nos
3. Amplifier Kit   -1 No
4. Multimeter   -1 No
5. A.C Mains cable with plug   - as per the need
6. Battery terminal block   **-1 No**

1. Task analysis

A. Knowledge

1. Familiarization of various audio cables and connectors.
2 Familiarization of amplifier
3. Familiarization of microphone
4. Familiarization of loud speaker
5. Working with installation and un-installation of PA system
6. Precautions in handling the equipment

B. Skill

CATEGORY OF SKILL	SUB TASK
Handling of Apparatus	A. Identification of different ports on front panel and rear panel of amplifier B. Identifying various cables and connectors used in PA system C. Identifying the functional knobs and terminal of speakers and microphone. D. Identifying other accessories (sockets)
Manipulation of apparatus	A. To make the connection and interconnections to equipment B. Checking the connections. C. connecting D.C battery as standby power source D. Testing of loud speaker and microphone
Precise operations/Activities	A. Testing of Loud speaker output by changing control knobs on amplifier. B. Arrangements of Loud speakers for effective audio quality. C. Precise setting of various voice setting as per user desire. D. Using appropriate ports for connecting external devices. E. Testing of DC battery condition.

2. Teaching points:

Sl No	Teaching Point	Time allocation (Suggestive) 15min
1	Operation of amplifier	3
2	Operation of loud speaker	3
3	Operation of microphone	3
4	PA system arrangement	5
5	Battery checkup	1

A. Procedural precautions.

1. Disconnect all the equipment from mains before making connections.
2. Ensure the settings in amplifier and speakers are CORRECT
3. Get the connections checked by the concerned staff member.
4. Ensure that there are no loose connections.
5. Ensure whether the microphone is working condition.

B. Safety precautions.

1. Care must be taken while operating the equipment.
2. Wear shoes for the lab.

3. Need and scope of experiment.

Communicating message effectively to public in big gathering auditorium or venue

4. Planning and organization:

Action	Activity
Check for	➢ Amplifier, speaker, microphone ports ➢ Connecting wires ➢ The student entry behavior. ➢ Availability of first aid kit
For design of instruction	❖ Read the teaching points carefully.

5. Scheme of Evaluation:

SKILL	SUB TASK	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY						TOTAL
1.Handling of Apparatus	A. Identification of different ports on front panel and rear panel of amplifier B. Identifying various cables and connectors used in PA system C. Identifying the functional knobs and terminal of speakers and microphone. D. Identifying other accessories (sockets)	**A** 2	**B** 1	**C** 1	**D** 1	**T** 5		
2.Manipulation of apparatus	A. To make the connection and interconnections to equipment B. Checking the connections. C. connecting D.C battery as standby power source D. Testing of loud speaker and microphone	**A** 5	**B** 2	**C** 2	**D** 6	**T** 15		
3.Precise operations/ Activities	A. Testing of Loud speaker output by changing control knobs on amplifier. B. Arrangements of Loud speakers for effective audio quality. C. Precise setting of various voice setting as per user desire. D. Using appropriate ports for connecting external devices. E. Testing of DC battery condition.	**A** 8	**B** 7	**C** 2	**D** 4	**E** 4	**T** 25	

4.values	A. Co Operation B. Co-Ordination C. Communication D. Sharing E .Leadership	T		
		5		
	TOTAL	**50**		

6. Assessment / Viva Questions:

1. What is the function of loud speaker?

2. What is the function of amplifier?

1. What is the function of microphone?

4. How many watts does a PA system need?

5. Loud speaker testing based on which parameters?

SMART TV

OBJECTIVE: To measure the explore the various features of smart TV.

APPARATUS REQUIRED: 1. Smart TV- 1No.
                                 2. Accessories – 1 set
                                 3. Cables and connectors – as required
                                 4. Bluetooth speakers -1No
                                 5. Smart phone-1 no

2.   TASK ANALYSIS:

A. KNOWLEDGE

   1. Familiarization of various audio and video cables and connectors.
   2. using of smart phone.
   3. Settings of network connectivity features of smart phone.
   4. Working with network and storage devices.
   5. Working with installation and un-installation of software in smart devices
   6. Precautions in handling the equipment

B. SKILL

Handling of Apparatus	a. Identification of different ports on rear panel.
	b. Identifying various cables and connectors used in smart TV
	c. Identifying various functional switches on smart TV remote control.
	d. Identifying other accessories (such as wall mount, Bluetooth speakers, set-top box etc.).
	e. Identifying various preloaded software components.
Manipulation of apparatus	a. Activating web connectivity.
	b. Enabling screen mirroring process.
	c. Pairing smart devices such as Bluetooth speakers etc., with smart TV.
	d. Connecting external storage devices with smart TV.
	e. Browsing web content through smart TV.
Precise operations/Activities	a. Installation of OS updates
	b. Installation of required apps from play-store
	c. Protecting smart TV from security attacks using proper antivirus software
	d. Precise setting of various video/voice settings as per the users desire
	e. Using appropriate ports for connecting external devices

2. TEACHING POINTS:

Sl No	Teaching Point	Suggested Time-15 min
1.	Identification of different ports on rear panel.	1
2.	Identifying various cables and connectors used in smart TV	1
3.	Identifying various functional switches on smart TV remote control.	1
4.	Identifying other accessories (such as wall mount, Bluetooth speakers, set-top box etc.)	1
5.	Identifying various preloaded software components.	1
6.	Identification of different ports on rear panel.	1
7.	Identifying various cables and connectors used in smart TV	1
8.	Activating web connectivity.	2
9.	Enabling screen mirroring process.	2
10.	Pairing smart devices such as Bluetooth speakers etc., with smart TV.	2
11.	Connecting external storage devices with smart TV.	1
12.	Precautions.	1

A. PROCEDURAL PRECAUTIONS:

- Ensure that all the equipment is disconnected from mains before making connections.
- Handle the equipment with care
- Ensure that there are no loose connections.
- Get the connections checked by the concerned staff member.
- Protect your router credentials
- Sort your networks and devices
- Configure your Smart TV
- Install the latest updates
- Use a complete security solution
- Download applications with caution
- Use streaming with caution

B. SAFETY PRECAUTIONS:

- Do not connect power to the equipment until required connections are finished and after carefully checking the connections as per the manual.
- If you smell anything burning, immediately disconnect the power and examine your circuit to find out what went wrong.
- Keep your work area dry.

3. NEED AND SCOPE OF EXPERIMENT

This experiment allows the students to explore about various features of smart television. It gives hands on training on installation and usage of smart TV. This exercise helps to learn the advanced smart technologies such as Internet of Things and their internetworking with other smart devices.

4. PLANNING AND ORGANISATION:

ACTION	ACTIVITY
Check for	- Smart TV. - Remote control. - Bluetooth Speakers - Cables and connectors - Smart Phone - First aid kit - Smart TV manual
For Design of Instruction	Read teaching points carefully.

5. SCHEME OF EVALUATION:

CATEGORY OF SKILL	SUB TASK	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY
1. Handling of apparatus	A. Identification of different ports on rear panel. B. Identifying various cables and connectors used in smart TV C. Identifying various functional switches on smart TV remote control. D. Identifying other accessories (such as wall mount, Bluetooth speakers, set-top box etc.) E. Identifying various preloaded software components.	<table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>T</td></tr><tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>5</td></tr></table>
2. Manipulation of apparatus	A. Activating web connectivity. B. Enabling screen mirroring process. C. Pairing smart devices such as Bluetooth speakers etc., with smart TV. D. Connecting external storage devices with smart TV. E. Browsing web content through smart TV.	<table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>T</td></tr><tr><td>5</td><td>5</td><td>3</td><td>1</td><td>1</td><td>15</td></tr></table>
3.Precise operations/Activities	A. Installation of OS updates B. Installation of required apps from play-store C. Protecting smart TV from security attacks using proper antivirus software D. Precise setting of various video/voice settings as per the users desire E. Using appropriate ports for connecting external devices	<table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>T</td></tr><tr><td>5</td><td>5</td><td>5</td><td>5</td><td>5</td><td>25</td></tr></table>
4.Values	A. Co-operation. B. Co-ordination C. Communication D. Sharing E. leadership	5
Total		50

ASSESSMENT / VIVA QUESTIONS:

1. Calculate the resistance value of a resistor which has the color bands red, red, red and gold.
2. What are the color bands of a resistor whose resistance value is 1kΩ±10%
3. Find the capacitance value of a disc capacitor whose value is marked as 102 on its body.
4. Why do we need zero adjustment in LCR meter?
5. For which type of capacitors the polarity of the terminals must be considered.
6. How can you measure the equivalent capacitance of two capacitors connected in parallel using LCR meter?
7. What are the parameters other than R, L, C that can be measured using LCR meter?
8. How do you identify the set range in LCR meter is not suitable while measuring ?

Record and reproduce voice digitally

OBJECTIVE:

To study record and reproduce voice digitally

APPARATUS REQUIRED:

1. C8051F411 microcontroller
2. Speaker.
3. Microphone.
4. Push button and LED.
5. Flash Memory.

2. TASK ANALYSIS:

A.   KNOWLEDGE

1. Familiarization of working of Loud Speaker and Microphone.

2. Knowledge of Microcontroller- ADC &DAC.

3. Knowledge of Flashmemory.

4. Knowledge of filters and noise cancellation techniques .

5. Precautions.

B. SKILL

Handling of Apparatus	• Identify various components. • Select the proper Microcontroller IC. • Identification of various interfacing devices. • Selecting the proper memory chip.
Manipulation of apparatus	• Draw the Block Diagram. • Making the connections as per the block diagram. • Adjust the volume of amplifier. • Record the voice signal through MIC and ADC. • Replay the voice signal through DAC and loudspeaker.
Precise operations/Activities	• Test the connections. • Test the Microcontoller chip. • Test the memory chip and interfacing devices. • Test the quality of voice output.

2. TEACHING POINTS:

3. Teaching Points

Sl No	Teaching Point	Suggested Time-15 min
1.	Need for Voice recorder digitally	1
2	Working of speaker and microphone.	2
3	Working of ADC and DAC.	1
4	Types of Interfacing devices,filters and memory.	2
5	Handling of speakers and microphone to get good quality.	3
6	Precautions.	1

A. PROCEDURAL PRECAUTIONS:

- Disconnect all the equipment from mains before making connections
- Connect the system as per the block diagram.
- Get the connections checked by the concerned staff member
- Select correct volume range of amplifier.
- Maintain proper power supply
- Ensure that there are no loose connections.

B. SAFETY PRECAUTIONS:

- Never work on a system while power is applied.
- Do not connect power to the system until the system is finished and you have carefully checked your work.
- If you smell anything burning, immediately disconnect the power and examine your system to find out what went wrong.
- Keep your work area dry.

3. NEED AND SCOPE OF EXPERIMENT

This experiment is essential to understand the voice recording and reproduction digitally.

4. PLANNING AND ORGANISATION:

ACTION	ACTIVITY
Check for	- The working condition of speakers and microphone. - Volume adjustment of amplifier. - Connecting interfaces, microcontroller and memory. - The students entry behavior.
For Design of Instruction	Read teaching points carefully.

5. SCHEME OF EVALUATION:		
CATEGORY OF SKILL	**SUB TASK**	**WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY**
1. Handling of apparatus	A. Identify various components. B. Select the proper Microcontroller IC. C. Identification of various interfacing devices. D. Selecting the proper memory chip.	A B C D T 1 1 1 2 5
2. Manipulation of apparatus	A. Draw the Block Diagram. B. Making the connections as per the block diagram. C. Adjust the volume of amplifier. D. Record the voice signal through MIC and ADC and replay the voice signal through DAC and loudspeaker.	A B C D T 3 3 4 5 15
3.Precise operations/ Activities	A. Test the connections. B. Test the Microcontoller chip. C. Test the memory chip and interfacing devices. D. Test the quality of voice output.	A B C D T 4 5 4 12 25
4.Values	A. Co-operation. B. Co-ordination C. Communication D. Sharing E. leadership	5
Total		50

ARRANGE LCD PROJECTOR

OBJECTIVE :   To arrange LCD projector.

APPARATUS REQUIRED   :

1.   Personal Computer /Lap top

2.   LCD Projector

3.   Projector Power Chord

4.   VGA Cable

5.   Speakers

6.   Screen

1. TASK ANALYSIS:

A.KNOWLEDGE

1.   Operating a PC
2.   PC's rear panel ports
3.   VGA cable
4.   Audio & power cables and jacks
5.   Careful handling of PC, LCD Projector, cables and accessories
6.   Precautions

B.SKILL

Handling of Apparatus	A. Identifying various terminals in the Projector B. Switching ON/OFF of Personal computer C. Identifying various functional keys of remote control D. Selecting the connecting cables E. Identifying various accessories of LCD projector
Manipulation of apparatus	A. Make the connections as per the diagram. B. Connect the VGA cable from the VGA port of PC/Laptop to the VGA port on the Projector. C. Plug the projector power chord into projector and into electrical outlet. D. Check the air filter and clean it if necessary E. Take off the Projector cap and Turn on Laptop and Projector
Precise operations/Activities	A. Adjust the focus control until a clear image appears on the screen B. Adjust the image size and shape properly using function keys C. Adjust the brightness of the image as per the requirement D. Connect speakers to the PC/LCD Projector and adjust the sound controls till the audio is clear E. Use remote control keys for controlling the LCD projector

3. Teaching Points:

S.No	Teaching Points	Suggested Time-15 min
1	Operation of LCD Projector	3
2	Identification of various Terminals, Cables, Connectors in Projector.	7
3	Connecting procedure and adjusting the controllers in projectors	3
4	Precautions	2

A.   PRECAUTIONS:

Installation

1. For best results, use your projector in a darkened room.

2. Place the projector on a flat, level surface in a dry area away from dust and moisture.

3. Do not place your projector in direct sunlight, near heaters or heat radiating appliances.

4. Exposure to direct sunlight, smoke or steam can harm internal components.

5. Handle your projector carefully. Dropping or jarring can damage internal components.

6. Do not place heavy objects on top of the projector.

3. Need of Experiment:

Projectors help that communication by expanding the image of your computer screen to be large enough for room full of people to see. Some of real time examples are:
In education institutions:
Projectors are used in schooling area for describing a topic. With the aid of a projector, videos or photograph become more enjoyable and children can easily learn by fun way. Further, we can easily zoom-in or zoom-out the image to clear the vision and to search minor points
In Companies
Projectors are used in big MNC's and enterprises for meeting, presentation and conference purposes.
At Home
Projectors are even used as home theaters that permit you to see the movie or any serial on a massive display with a first-rate sound nice, which makes you feel like you are staring at live.

Scope of Experiment:

By learning installation of projector and its different features gives the basic knowledge as a technical aspirant and also adaptive for future new technologies.

4. Planning and Organization:

ACTION	ACTIVITY
Check for	- Computer system and Projector - Proper maintenance of power supply to the laboratory - Cables, Screen and Speakers - First-aid kit - The students entry behavior
For Design of Instruction	Read teaching points carefully.

5 . SCHEME OF EVALUATION:

CATEGORY OF SKILL	SUB TASK	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY
1. Handling of Apparatus	A. Identifying various terminals in the Projector B. Personal computer C. Identification of various components D. Selecting the connecting cables	10

2. Manipulation of apparatus	A. Make the connections as per the diagram. B. Connect the VGA cable from the VGA port of PC/Laptop to the VGA port on the Projector. C. Plug the projector power chord into projector and into electrical outlet. D. Check the air filter and clean it if necessary E. Take off the Projector cap and Turn on Laptop and Projector	15
3.Precise operations/Activities	A. Adjust the focus control until a clear image appears on the screen B. Adjust the image size and shape properly using function keys C. Adjust the brightness of the image as per the requirement D. Connect speakers to the PC/LCD Projector and adjust the sound controls till the audio is clear E. Use remote control keys for controlling the LCD projector	25
4.Values	A. Co Operation B. Co-Ordination C. Communication D. Sharing E. Leadership	5
	Total	50

ASSESSMENT / VIVA QUESTIONS:

1. What is the basic Principle of operation of LCD projector?

2. How many types of LCD projectors are there?

3. What are the various parts of LCD projectors?

4. What are the different features of LCD?

5.1 Channel Audio System

OBJECTIVE:

To set up and test 5.1 channel audio systems

APPARATUS REQUIRED:

1. Center Speaker.
2. Left and Right Speakers.
3. Subwoofer.
4. Left and Right surround speaker.
5. Cables.

2. **TASK ANALYSIS:**

A. **KNOWLEDGE**

1. Familiarization of working of Loud Speaker.

2. Knowledge of types of speakers.

3. Knowledge of Stereo and Dolby systems.

4. Knowledge of types of Connectors.

5. Precautions.

B. SKILL

Handling of Apparatus	• Identifying various types of speakers. • Identifying correct position of speakers. • Identification of various connectors. • Selecting the connecting wires.
Manipulation of apparatus	• Draw the Block Diagram. • Making the connections as per the block diagram. • Adjusting the proper position of Speakers and Woofer. • Connect the power supply to woofer. • Adjust the volume of speakers and woofer.
Precise operations/Activities	• Test the connections. • Test the speakers and woofer. • Test the quality of sound.

3. Teaching Points

Sl No	Teaching Point	Suggested Time-15 min
1.	Need for Audio System	1
2	Working of speaker and woofer.	2
3	Types of speakers	1
4	Types of Audio Systems.	2
5	Handling of speakers and woofer to get good quality.	3
6	Precautions.	1

A. <u>PROCEDURAL PRECAUTIONS:</u>

- Disconnect all the equipment from mains before making connections
- Connect the audio system as per the block diagram.
- Get the connections checked by the concerned staff member
- Select correct volume range of speakers and woofer.
- Maintain proper power supply
- Ensure that there are no loose connections.

B. <u>SAFETY PRECAUTIONS:</u>

- Never work on a system while power is applied.
- Do not connect power to the system until the system is finished and you have carefully checked your work.
- If you smell anything burning, immediately disconnect the power and examine your system to find out what went wrong.
- Keep your work area dry.

3. <u>NEED AND SCOPE OF EXPERIMENT</u>

This experiment is essential to create stereo sound for music and other sound effects in Dolby Digital and DTS.

4. <u>PLANNING AND ORGANISATION:</u>

ACTION	ACTIVITY
Check for	• The working condition of speakers and woofer. • Volume and boss adjustments on the speaker. • Connecting cables. • The students entry behavior.
For Design of Instruction	• Read teaching points carefully.

5. SCHEME OF EVALUATION:		
CATEGORY OF SKILL	**SUB TASK**	**WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY**
1. Handling of apparatus	A. Identifying various speakers. B. Identification of various connectors C. Setting the speakers to correct volume. D. Placing the speakers at correct position.	<table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>T</td></tr><tr><td>1</td><td>1</td><td>1</td><td>2</td><td>5</td></tr></table>

2. Manipulation of apparatus	A. Draw the Block Diagram. B. Making the connections as per the block diagram. C. Adjusting the proper position of Speakers and Woofer. D. Connect the power supply to woofer and adjust the volume of speakers and woofer.	A	B	C	D	T
		3	3	4	5	15

3.Precise operations/Activities	A. Test the connections. B. Test the speakers and woofer. C. Test the position. D. Test the quality of sound.	A	B	C	D	T
		4	5	4	12	25

4.Values	A. Co-operation. B. Co-ordination C. Communication D. Sharing E. leadership	5

Total	50

VIVA QUESTIONS:

1. What is Surround Sound?

2. What is the purpose of SUBWOOFERS?

3. Mention the use of tweeters?

4. What is the meaning of 5.1 channel audio system?

5. List the types of dolby systems?

6. Mention the angle position of speakers in home theater sound system?

Measurement of R, L and C using LCR meter

Name of the student		Date of experiment
PIN	Branch :	
Institution		Experiment No.

1. Title of the Experiment : _____

2. Objective of the Experiment : _____
3. Equipment Required : _____
   _____
   _____
   _____

 4. Circuit diagram/ Front Panel Diagram :

5. Procedure

6. *__Readings/ Observations__*:

Resistance Measurement

S.No	Resistance value		Remarks
	As per color code/marked value	As per LCR meter	

Capacitance Measurement

S.No	Capacitance value		Remarks
	As per color code/marked value	As per LCR meter	

Inductance Measurement

S.No	Inductance value		Remarks
	As per color code/marked value	As per LCR meter	

8. Inference and Interpretation:

9. Scheme of Evaluation

CATEGORY OF SKILL	SUB TASK	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY	Marks Awarded
1. Handling of apparatus	A). Identifying various terminals B) Using correct range of LCR meter. C) Setting the Potentiometer(POT) to correct values. D) Identification of capacitor, inductor and Resistor values. E) Identifying various front panel controls	10	
2. Manipulation of apparatus	A) Sketch the front panel diagram B) A. Setup the LCR meter to suitable settings for the measurement of R, L and C. C) Set the function selector and range to measure Resistance. D) Set the function selector and range to measure Inductance E) Set the function selector and range to measure Capacitance.	10	
3. Precise operations / Activities	A. Adjusting zero controls to fine tune the equipment for measurement of R, L and B. Calculation of theoretical values C. Compare measured values with theoretical values	25	
4. Values	A. Cooperation B. Coordination C. Communication D. Sharing E. Leadership	5	
		Total	$\overline{50}$
Signature of the staff			Signature of the Student

WORK SHEET

Name of the student :		Date of experiment:
PIN :	Branch:	
Institution:		Experiment No.

1. Title of the Experiment: _____

2 .Objective of the Experiment: _____To test

3 .Equipment Required: _____

4. PROCEDURE:-

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

5. <u>OBSERVATIONS:-</u>

S.NO	IC number	Status

6. <u>Inferences and Interpretations</u>

7. Scheme of Evaluation:

CATEGORY OF SKILL	SUB TASK	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY	Marks Awarded
1. Handling of apparatus	A. Identifying the controls on IC tester. B. Identifying the display codes in IC tester. C. Using the IC tester. D. Placing the IC in ZIF socket.	10	
2. Manipulation of apparatus	A. Placing the IC in IC tester with proper orientation. B. Locking the IC using lever on IC tester. C. Using proper control keys. D. Observing the status from display.	20	
3.Precise Operations /Activities	A. Reading the status of the IC. B. Recording the IC number from display. C. Checking all the pins of IC tester.	15	
Values	A. Co-operation B. Co-ordination C. Communication D. Sharing E. Leadership	**5**	

SIGNATURE OF STAFF   SIGNATURE OF STUDENT

DIGITAL FREQUENCY METER

NAME OF THE STUDENT :		DATE OF EXPERIMENT:
PIN:	BRANCH : ECE	
INSTITUTION:		EXPERIMENT NO:

1. Title of the Experiment: _____

2. Objective of the Experiment: _____

 3. Equipment Required: _____
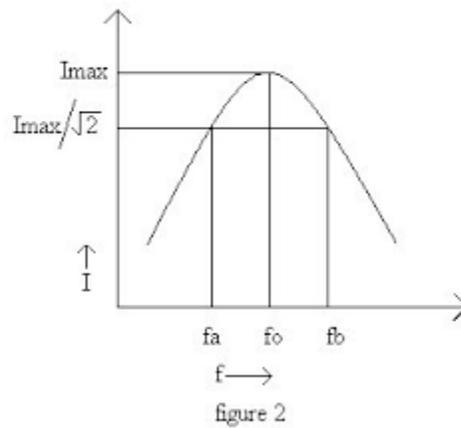
                                    _____

4. Circuit Diagram:

5. Procedure:

Sl No.	Procedure
1	
2	
3	
4	
5	
6	
7	
8	
9	

6. Readings:

S.NO	Input frequency	Output frequency
1		
2		
3		
4		

7. Inference and Interpretation:

8. Scheme of evaluation:

Category of skill	Subtask	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY	MARKS AWARDED
Handling apparatus	a. Identification of Components and its terminals b. Using correct range meters. c. Identifying any error in function generator	5	
Manipulations of apparatus	a) Drawing the circuit diagram b) Selecting required components c) Making the connections as per the Circuit. d) Apply the different frequencies in function generator	15	
Precise operations/ activities	a. Measuring the output frequency corresponding to input signal. b. Recording the values of output and input frequencies	25	
Values	• Co-operation • Co-ordination • Communication • Sharing • Leadership	5	
		TOTAL	50

SIGNATURE OF STAFF   SIGNATURE OF STUDENT

WORK SHEET

Name of the student :		Date of experiment:
PIN :	Branch:	
Institution:		Experiment No.

1. Title of the Experiment: _____

2. Objective of the Experiment: _____

3. Equipment Required: _____

                         _____

4. Circuit Diagram:

5. Procedure:

Sl No.	Procedure
1	
2	
3	
4	
5	
6	
7	
8	
9	

6. READINGS:

Input Source voltage =   Volts

S.No	Frequency in Hz	Current (I) in mA
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		

7. MODEL GRAPH:

Model Graph

figure 2

8.Graph:

9. Interpretation of graph and results:

10. Scheme of Evaluation

Category of skill	Subtask	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY	MARKS AWARDED
Handling apparatus	A. Identification of components. B. Setting of values on DLB and DCB C. Selecting correct range of Ammeter. D. Selecting the correct type of ammeter E. Proper handling of the function generator	<table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>T</td></tr><tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>5</td></tr></table>	
Manipulations of apparatus	A. Drawing the circuit diagram. B. Making the connections as per the circuit diagram. C. Switching on the supply to the function generator.. D. Setting the input source voltage at a constant voltage E. Observing the readings in ammeter	<table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>T</td></tr><tr><td>5</td><td>5</td><td>2</td><td>1</td><td>2</td><td>15</td></tr></table>	
Precise operations/activities	A. Measuring the ac input voltage B. Recording the readings of ammeter by varying the frequency in steps of 1Khz. Tabulating the readings. C. Plotting the curve between frequency and current D. Observing the frequency at which maximum current flows through the circuit. E. Verifying the occurrence of series resonance	<table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>T</td></tr><tr><td>5</td><td>5</td><td>5</td><td>5</td><td>5</td><td>25</td></tr></table>	
Values	A. Co-operation B. Co-ordination C. Communication D. Sharing E. Leadership	5	
		TOTAL	50

SIGNATURE OF STAFF   SIGNATURE OF STUDENT

WORK SHEET

Name of the student :	Date of experiment:
PIN :	Branch:
Institution:	Experiment No.

1. Title of the Experiment: _____

2. Objective of the Experiment: _____
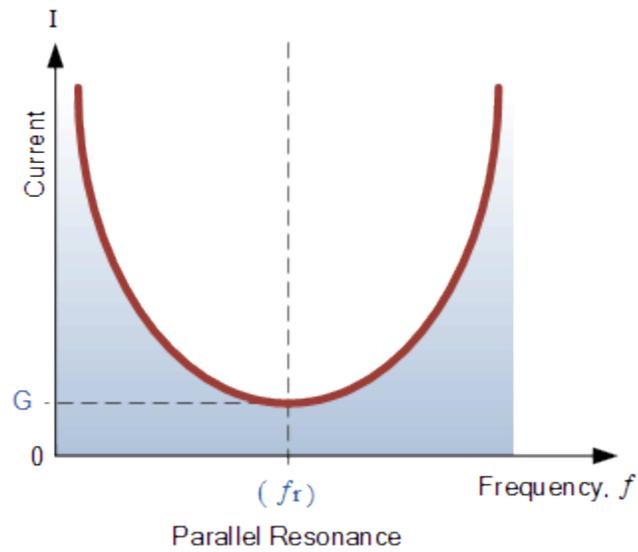
3. Equipment Required: _____

_____

4. Circuit Diagram:

5. Procedure:

Sl No.	Procedure
1	
2	
3	
4	
5	
6	
7	
8	
9	

6. READINGS:

Input Source voltage =   Volts

S.No	Frequency in Hz	Current (I) in mA
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		

7. MODEL GRAPH:

Parallel Resonance

8.Graph:

9. Interpretation of graph and results:

10. **Scheme of Evaluation**

Category of skill	Subtask	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY	MARKS AWARDED
Handling apparatus	A. Identification of components. B. Setting of values on DLB and DCB C. Selecting correct range of Ammeter. D. Selecting the correct type of ammeter E. Proper handling of the function generator	<table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>T</td></tr><tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>5</td></tr></table>	
Manipulations of apparatus	A. Drawing the circuit diagram. B. Making the connections as per the circuit diagram. C. Switching on the supply to the function generator.. D. Setting the input source voltage at a constant voltage E. Observing the readings in ammeter	<table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>T</td></tr><tr><td>5</td><td>5</td><td>2</td><td>1</td><td>2</td><td>15</td></tr></table>	
Precise operations/activities	A. Measuring the ac input voltage B. Recording the readings of ammeter by varying the frequency in steps of 1Khz. Tabulating the readings. C. Plotting the curve between frequency and current D. Observing the frequency at which minimum current flows through the circuit. E. Verifying the occurrence of parallel resonance	<table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>T</td></tr><tr><td>5</td><td>5</td><td>5</td><td>5</td><td>5</td><td>25</td></tr></table>	
Values	A. Co-operation B. Co-ordination C. Communication D. Sharing E. Leadership	5	
		TOTAL	50

SIGNATURE OF STAFF   SIGNATURE OF STUDENT

Thevenin's theorem work sheet

Name of the student		Date of experiment
PIN	Branch :	
Institution		Experiment No.

1. Title of the Experiment : _____

2. Objective of the Experiment : _____
3. Equipment Required : _____
                                    _____
                                    _____
                                    _____

4. Circuit diagram :

5. Procedure

6. Readings:

(a) To find Load current I_L :

S. No	Source (or) Applied Voltage , V_S(Volt)	Current I_L(mA)

(b) To Find V_{th} :

S. No	Source Voltage , V_S(Volt)	Thevenins equivalent voltage V_{th} (Volt)

(c)   To find R_{th} :

Thevinins Resistance R_{th} =_____ Ohms

(d) To find Load current I_L' using Thevenins Equivalent Circuit:

S. No	Thevenins equivalent voltage V_{th} (Volt)	Current I_L' (mA)

8. Inference and Interpretation:

9. Scheme of Evaluation

CATEGORY OF SKILL	SUB TASK	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY	Marks Awarded
1. Handling of apparatus	A. Drawing circuit diagram and identifying various terminals B. Using correct range of ammeter	10	
2. Manipulation of apparatus	A. Setup the RPS to suitable voltages.	10	
3. Precise operations / Activities	A. Recording the readings in Ammeter B. Calculation of theoretical values C. Compare practical with theoretical values	25	
4. Values	A. Cooperation B. Coordination C. Communication D. Sharing E. Leadership	5	
		Total	$\overline{50}$
Signature of the staff			Signature of the Student

Super position theorem work sheet

Name of the student		Date of experiment
PIN	Branch :	
Institution		Experiment No.

1. Title of the Experiment : _____

2. Objective of the Experiment : _____
3. Equipment Required : _____
   _____
   _____
   _____

   4. Circuit diagram:

5. Procedure

6. Readings:

- When both the sources are acting :

S.No	Applied Voltage		Current
	V_1(Volts)	V_2(Volts)	I_L(mA)

- When 20V source is acting alone   When 5V source is acting alone

S. No	Applied Voltage V_1 (volts)	Current I'_L(mA)

S. No	Applied Voltage V_2 (volts)	Current I''_L (mA)

Verify,

- Comparison between theoretical and practical values

S.No	Load current	Theoretical Values	Practical Values
1.	When Both sources are acting, I_L	3.98 mA	_____ mA
2.	When only source 'X' is acting I_L'	2.4 mA	_____ mA
3.	When source 'Y' is acting, I_L''	1.58 mA	_____ mA

8. Inference and Interpretation:

9. Scheme of Evaluation

CATEGORY OF SKILL	SUB TASK	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY	Marks Awarded
1. Handling of apparatus	A. Drawing circuit diagram and identifying various terminals B. Using correct range of ammeter	10	
2. Manipulation of apparatus	A. Setup the RPS to suitable voltages.	10	
3. Precise operations / Activities	A. Recording the readings in Ammeter B. Calculation of theoretical values C. Compare practical with theoretical values	25	
4. Values	A. Cooperation B. Coordination C. Communication D. Sharing E. Leadership	5	
		Total	$\overline{50}$
Signature of the staff			Signature of the Student

WORK SHEET

Name of the student :		Date of experiment:
PIN :	Branch:	
Institution:		Experiment No.

1. Title of the Experiment: _____

2. Objective of the Experiment: _____

3. Equipment Required: _____

          _____

4. Circuit Diagram:

5. Procedure:

Sl No.	Procedure
1	
2	
3	
4	
5	
6	
7	
8	
9	

6. READINGS:

Input Source voltage = 10V

S.No	Load Resistance (R_L) in kΩ	Load current (I_L) in mA	Power delivered $P_L = I^2 R_L$ in mW
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			

7. MODEL GRAPH:

Model Graph
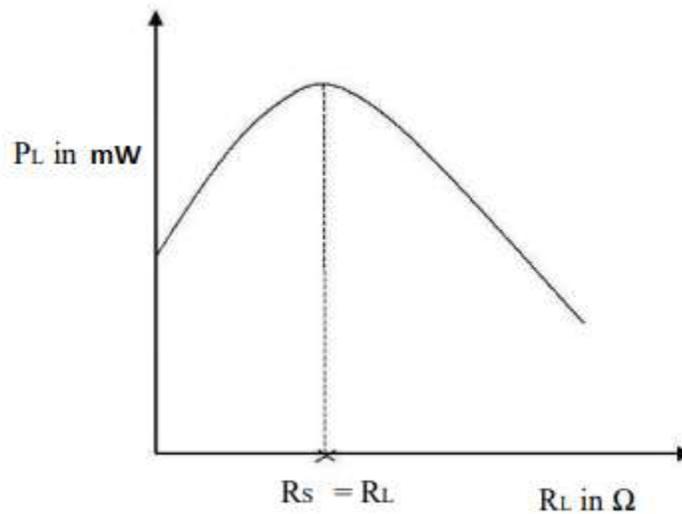
Fig. Load resistance versus power delivered model graph

8.Graph:

9. Interpretation of graph and results:

10. Scheme of evaluation:

Category of skill	Subtask	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY	MARKS AWARDED
Handling apparatus	a. Identification of components. b. Identifying terminals of the DRB and its each dial range c. Selecting correct range of Ammeter. d. Selecting the correct type of ammeter e. Proper handling of the RPS	5	
Manipulations of apparatus	a. Drawing the circuit diagram. b. Make the connections as per the circuit diagram. c. Switching on the supply to and RPS. d. Observing the readings in voltmeter	15	
Precise operations/ activities	a. Setting the input source voltage at a constant voltage b. Recording the readings of ammeter by varying the load resistance (DRB) in steps of 200Ω. c. Tabulating the values d. Calculating the power delivered to load resistor in each step. e. Plotting the load resistance versus power delivered graph. f. Finding the load resistance at which maximum power is transferred. g. Verifying the maximum power transfer theorem. h. Calculating of theoretical maximum power transferred and verifying with the experimental value.	25	
Values	• Co-operation • Co-ordination • Communication • Sharing • Leadership	5	
		TOTAL	50

SIGNATURE OF STAFF   SIGNATURE OF STUDENT

WORK SHEET

Name of the student:		Date of experiment:
PIN:	Branch:	
Institution:		Experiment No:

1. Title of the Experiment: _____

2. Objective of the Experiment:_____

3. Equipment Required: _____

_____

_____

4. Circuit Diagram:

5. Procedure

6. Results

➢ **AC measurement**

S No	Input Frequency	No. of vertical divisions	Volts/Div	$V_{pp=}$ No. of vertical divisions X Volts/Div	$V_{rms} = \dfrac{V_{pp}}{2\sqrt{2}}$

➢ **DC measurement**

S No	RPS output (Volts)	No. of vertical divisions	Volts/Div	$V_{DC=}$ No. of vertical divisions X Volts/Div

7. Inference and Interpretation:

8. Scheme of Evaluation:

SKILL	SUB TASK	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY	TOTAL
1.Handling of Apparatus	A. Identifying various pins and control panels on CRO, function generator and RPS. B. Making correct setting on CRO to get stable waveforms. C. Varying the frequency and amplitude knobs on CRO. D. Select the amplitude and frequency on function generator. E. Select the amplitude from RPS	5	

2.Manipulation of apparatus	A. Making the Circuit connections. B. Checking the connections. C. Generating the sine wave from function generator D. Apply required DC voltage from RPS E. Setting of CRO in dual mode	15	
3.Precise operations/ Activities	A. Observing the sine wave by changing the amplitude and time period. B. Measuring the amplitude and time period from the wave forms on CRO and calculate the frequency C. Observing the DC signals by changing the amplitude. D. Measuring the amplitude for DC signal on CRO E. Drawing the waveforms and showing the salient features.	25	
4.values	A. Co Operation B. Co-Ordination C. Communication D. Sharing E .Leadership	T 5	
	TOTAL	**50**	

WORK SHEET

Name of the student:		Date of experiment:
PIN:	Branch:	
Institution:		Experiment No:

1. Title of the Experiment: _____

2. Objective of the Experiment:_____

3. Equipment Required: _____

_____

_____

4. Circuit Diagram:

5. Procedure

6. Results

> **Pulse Width and Duty cycle measurements**

S No	T_{ON}	T_{OFF}	T= T_{ON} + T_{OFF} (sec)	Rise time(t_r)	Fall time(t_f)	Duty Cycle= T_{ON} / (T_{ON} + T_{OFF})	Frequency
1							
2							
3							
4							
5							

> **Amplitude measurement**

S No	No. of vertical divisions	Volts/Div	Pulse Amplitude = No. of vertical divisions X Volts/Div

7. Inference and Interpretation:

8. Scheme of Evaluation:

SKILL	SUB TASK	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY	TOTAL
1.Handling of Apparatus	A. Identifying various pins and control panels on CRO and function generator. B. Making correct setting on CRO to get stable waveforms. C. Varying the frequency and amplitude knobs on CRO. D. Select the amplitude and frequency on pulse generator	5	
2.Manipulation of apparatus	A. Making the Circuit connections. B. Checking the connections. C. Generating the pulse wave from pulse generator D. Setting of CRO in dual mode	15	

3.Precise operations/ Activities	A. Observing the pulse wave by changing the amplitude and time period. B. Measuring the amplitude, time period, rise time and fall time from the wave forms on CRO and calculate the frequency. C. Calculate pulse width and duty cycle from observed wave forms D. Drawing the waveforms and showing the salient features.	25	
4.values	A. Co Operation B. Co-Ordination C. Communication D. Sharing E .Leadership	T 5	
	TOTAL	**50**	

WORK SHEET

Name of the student:		Date of experiment:
PIN:	Branch:	
Institution:		Experiment No:

1. Title of the Experiment: _____

2. Objective of the Experiment:_____

3. Equipment Required: _____

_____

_____

4. Circuit Diagram:

5. Procedure

6. Results

S No	Known Freq.	Lissajous Pattern	No of horizontal tangencies (f_h)	No of vertical tangencies (f_v)	$Unknown\ freq = \frac{No\ of\ horizontal\ tangents}{No\ of\ vertical tangents} x\ Known$ freq.

7. Inference and Interpretation:

8. Scheme of Evaluation:

SKILL	SUB TASK	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY	TOTAL
1.Handling of Apparatus	A. Identifying various pins and control panels on CRO and function generator B. Making correct setting on CRO to get stable waveforms. C. Varying the frequency and amplitude knobs on CRO. D. Select the amplitude and frequency for known and unknown signals from function generators.	5	
2.Manipulation of apparatus	A. Making the Circuit connections. B. Checking the connections. C. Generating the known and unknown sine waves from function generators D. Setting of CRO in X-Y mode E. Connect known signal and unknown signal to CRO	15	

3.Precise operations/ Activities	A. Generate Lissajous patterns by adjusting the voltage/div and time/div knobs on CRO. B. Measure number of horizontal and vertical tangents. C. Calculate unknown frequency D. Drawing the waveforms and showing the salient features.	25	
4.values	A. Co Operation B. Co-Ordination C. Communication D. Sharing E .Leadership	**T** 5	
	TOTAL	**50**	

WORK SHEET

Name of the student:		Date of experiment:
PIN:	Branch:	
Institution:		Experiment No:

1.Title of the Experiment: _____

2. Objective of the Experiment:_____

3. Equipment Required: _____

_____

_____

4. Circuit Diagram:

5. Procedure

7. Inference and Interpretation:

8. Scheme of Evaluation:

SKILL	SUB TASK	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY	TOTAL
1.Handling of Apparatus	A. Identification of different ports on front panel and rear panel of amplifier B. Identifying various cables and connectors used in PA system C. Identifying the functional knobs and terminal of speakers and microphone. D. Identifying other accessories (sockets)	5	
2.Manipulation of apparatus	A. To make the connection and interconnections to equipment B. Checking the connections. C. connecting D.C battery as standby power source D. Testing of loud speaker and microphone	15	
3.Precise operations/ Activities	A. Testing of Loud speaker output by changing control knobs on amplifier. B. Arrangements of Loud speakers for effective audio quality. C. Precise setting of various voice setting as per user desire. D. Using appropriate ports for connecting external devices. E. Testing of DC battery condition.	25	
4.values	A. Co Operation B. Co-Ordination C. Communication D. Sharing E .Leadership	T 5	
	TOTAL	**50**	

WORK SHEET

Name of the student :		Date of experiment:
PIN :	Branch:	
Institution:		Experiment No.

1. Title of the Experiment: _____

2. Objective of the Experiment: _____

3. Equipment Required: _____

                                       _____

4. a) Procedure: Browsing the web

Sl No.	Procedure
1	
2	
3	
4	
5	
6	
7	
8	
9	

b) Procedure: Online streaming

Sl No.	Procedure
1	
2	
3	
4	
5	
6	
7	
8	

c) Procedure: Screen mirroring

Sl No.	Procedure
1	
2	
3	
4	
5	
6	
7	
8	

d) Procedure: Connecting Bluetooth speakers

Sl No.	Procedure
1	
2	
3	
4	
5	
6	
7	
8	

e) Procedure: Voice control

Sl No.	Procedure
1	
2	
3	
4	
5	
6	
7	
8	

5. Scheme of evaluation:

Category of skill	Subtask	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY	MARKS AWARDED
Handling apparatus	a. Identification of different ports on rear panel. b. Identifying various cables and connectors used in smart TV c. Identifying various functional switches on smart TV remote control. d. Identifying other accessories (such as wall mount, Bluetooth speakers, set-top box etc.) e. Identifying various preloaded software components.	5	
Manipulations of apparatus	a. Activating web connectivity. b. Enabling screen mirroring process. c. Pairing smart devices such as Bluetooth speakers etc., with smart TV. d. Connecting external storage devices with smart TV. e. Browsing web content through smart TV.	15	
Precise operations/activities	a. Installation of OS updates b. Installation of required apps from play-store c. Protecting smart TV from security attacks using proper antivirus software d. Precise setting of various video/voice settings as per the users desire e. Using appropriate ports for connecting external devices	25	
Values	• Co-operation • Co-ordination • Communication • Sharing • Leadership	5	
		TOTAL	50

SIGNATURE OF STAFF   SIGNATURE OF STUDENT

WORK SHEET

Name of the student :		Date of experiment:
PIN :	Branch:	
Institution:		Experiment No.

1. Title of the Experiment:

2. Objective of the Experiment: _____

3. Equipment Required: _____
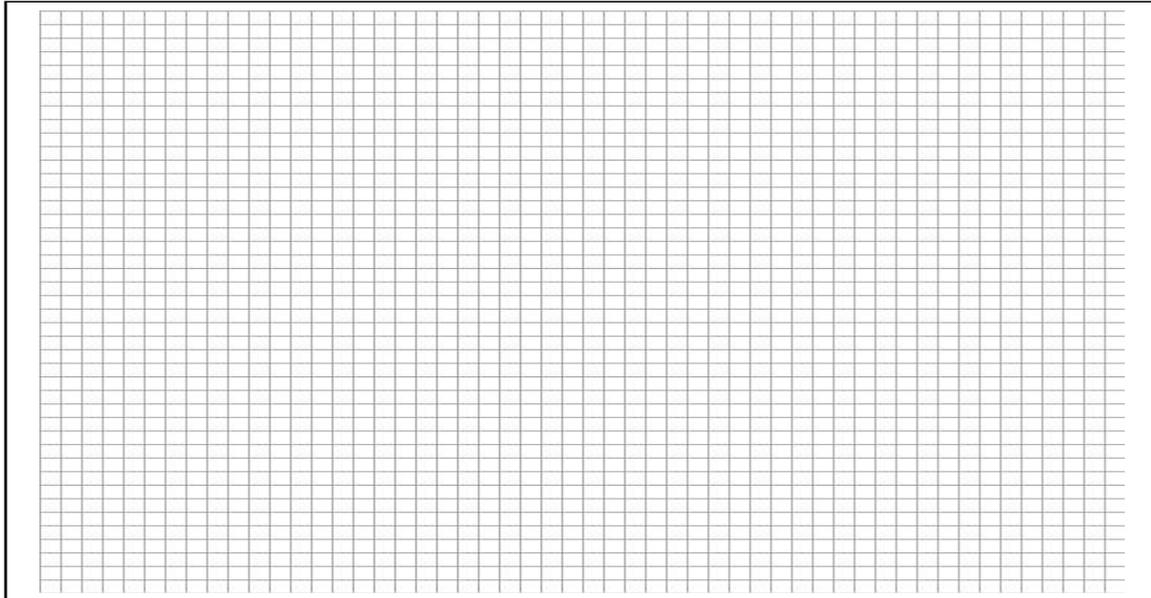
_____

4. Record and reproduce voice digitally Block diagram:

5. Procedure:

SI No.	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

6. Readings:

7. Model Graph:

8. Graph:

Observed Waveforms

9. Discussions:

5. SCHEME OF EVALUATION:			
CATEGORY OF SKILL	**SUB TASK**	**WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY**	
1. Handling of apparatus	A. Identify various components. B. Select the proper Microcontroller IC. C. Identification of various interfacing devices. D. Selecting the proper memory chip.	**5**	

2. Manipulation of apparatus	A. Draw the Block Diagram. B. Making the connections as per the block diagram. C. Adjust the volume of amplifier. D. Record the voice signal through MIC and ADC and replay the voice signal through DAC and loudspeaker.	**15**	
3.Precise operations/Activities	A. Test the connections. B. Test the Microcontoller chip. C. Test the memory chip and interfacing devices. D. Test the quality of voice output.	**25**	
4.Values	A. Co-operation. B. Co-ordination C. Communication D. Sharing E. Leadership	5	
		Total	
			50

Signature of the staff   **Signature of the Student**

WORK SHEET

Name of the student :		Date of experiment:
PIN :	Branch:	
Institution:		Experiment No.

1. Title of the Experiment:

2. Objective of the Experiment:

3. Equipment Required:

4. Connection diagram:

5. Procedure:

SI No.	Procedure

6. Inference and interpretation:

7. Scheme of Evaluation:

Category of skill	Sub task	Weightage with competency level individually	Marks awarded
1. Handling of Apparatus	A. Identifying various terminals in the Projector B. Personal computer C. Identification of various components D. Selecting the connecting cables	5	
2. Manipulation of apparatus	A. Make the connections as per the diagram. B. Connect the VGA cable to the VGA connector on Laptop And to the VGA port on the Projector. C. Plug the projector power chord into projector and into electrical outlet.	15	
3. Precise operations/ Activities	A. Turn on Laptop and Projector B. To display your Laptop screen ,hold down the function key and press one of the following : **F4,F5,F7,F8** C. Take off the Projector cap and focus projector D. Audio connect speakers into your Laptops headphone jack	25	
4.Values	A. Co Operation B. Co-Ordination C. Communication D. Sharing E. Leadership	5	
		Total	50

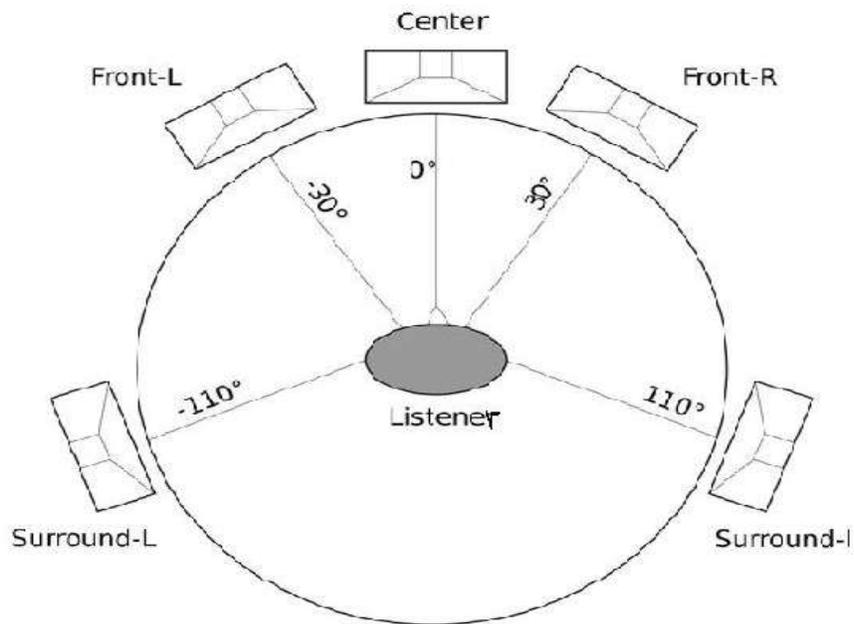Signature of the Staff   Signature of the Student

WORK SHEET

Name of the student :		Date of experiment:
PIN :	Branch:	
Institution:		Experiment No.

1. Title of the Experiment:

2. Objective of the Experiment: _____

3. Equipment Required: _____

                                  _____
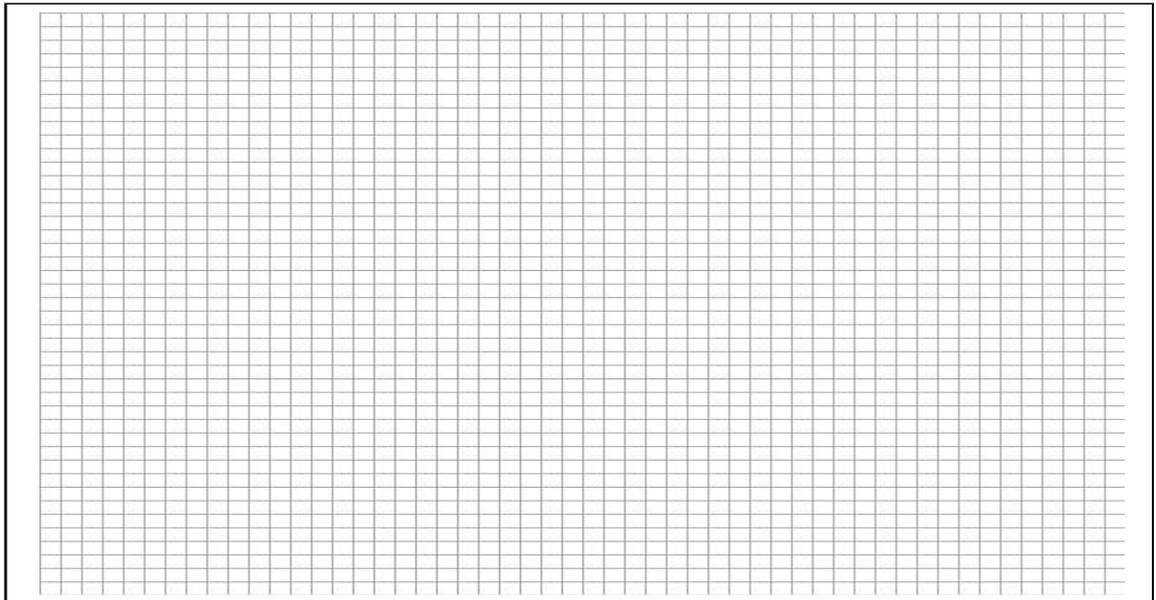
4. 5.1 Channel Audio System Block diagram:

5. Procedure:

SI No.	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

6. Readings:

7. Model Graph:

8. Graph:

Observed Waveforms

9. Discussions:

5. SCHEME OF EVALUATION:

CATEGORY OF SKILL	SUB TASK	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY	
1. Handling of apparatus	A. Identifying various speakers. B. Identification of various connectors C. Setting the speakers to correct volume. D. Placing the speakers at correct position.	5	
2. Manipulation of apparatus	A. Draw the Block Diagram. B. Making the connections as per the block diagram. C. Adjusting the proper position of Speakers and Woofer. D. Connect the power supply to woofer and adjust the volume of speakers and woofer.	15	
3.Precise operations/Activities	A. Test the connections. B. Test the speakers and woofer. C. Test the position. D. Test the quality of sound.	25	
4.Values	A. Co-operation. B. Co-ordination C. Communication D. Sharing E. Leadership	5	
	Total		
			50

Signature of the staff   **Signature of the Student**

Measurement of Resistance, Capacitance and Inductance using LCR Meter

1. *Description*

The setup for this experiment requires the following equipment

Name	Specifications/ Range	No	Purpose
Resistors	Assorted values	3	To measure their values
Inductors	Assorted values	3	To measure their values
Capacitors	Assorted values	3	To measure their values
LCR meter	Inductance: 0.1 nH ~ 50 kH Capacitance: 0.01pF ~ 1F Resistance: 0.01 mΩ to 50 MΩ	1	To measure the capacitance of capacitor
Connecting probes		Require number	

2. *Theory:*

An LCR meter is a type of electronic test equipment used to measure the inductance (L), capacitance (C), and resistance (R) of an electronic component.

The front panel diagram of a typical LCR meter is shown in the figure. It can measure six basic parameters ie., inductance L, capacitance C, resistance R, impedance Z, dissipation factor D and quality factor Q.

The functions of different front panel controls are given as follows:

1 **Parameter**
Displaying current measured parameters:
L-Q, C-D, R-Q, Z-Q, Z-D or AUTO
2 Frequency
Displaying current frequency; 100 Hz, 120 Hz or 1 KHz
3 Display Mode Displaying current display mode of the primary parameter: DIR %
4 Range Displaying range state: Auto, Hold or current range.
5 Pins Indication
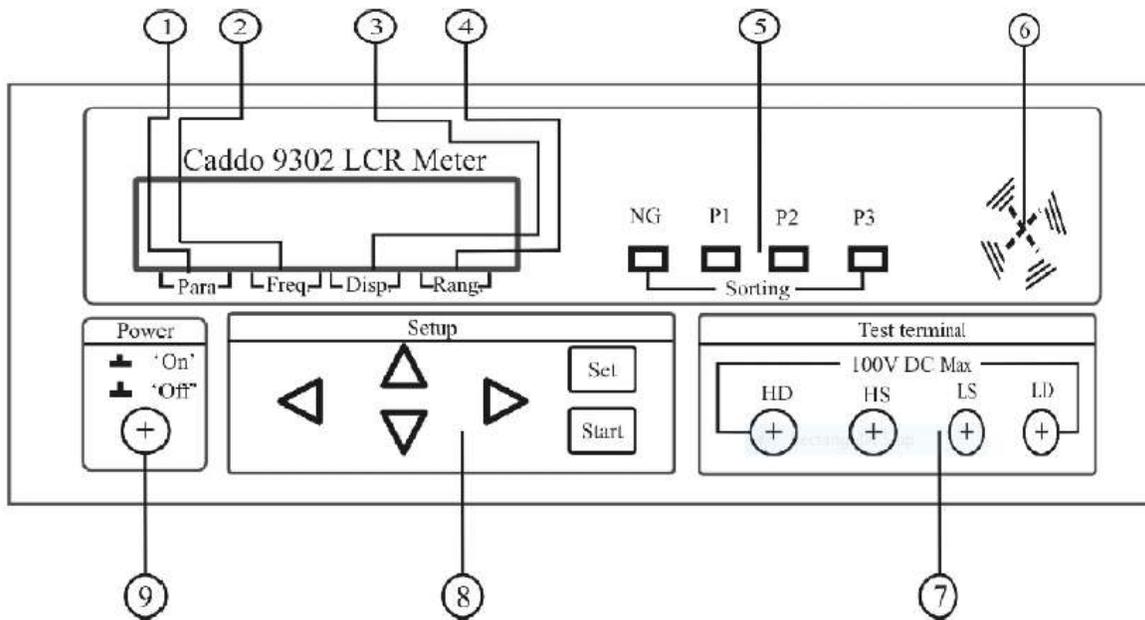NG: No-good; P1: Pass1; P2: Pass2; P3: Pass3;

Figure: Front Panel Diagram of LCR Meter

P1, P2, P3 Priority is lower in turn.
6 Buzzer
7 Test Terminals HD, HS, LS and LD
Cursor keys Function table moving and rolling Setup key Entering
8 Key function table setting Start key The executing confirmation of command
9 Power Power switch

Features
1. Zero Correction :
Open sweep correction of open circuit;
Short sweep correction of short circuit
2. Display Format :
Direct actual measured value absolute delta between the measured value and the reference value;
delta percent between the measured value and the reference value.
3. Range Hold : When measuring a large number of components with the same nominal value, this function can effectively improve the measuring speed.
4. Comparator Function : Caddo 9302s built-in comparator can sort components into a maximum of four bins (NG, P1, P2 and P3).
5. Equivalent Measurement Circuit : There are two equivalent circuit models: parallel and series.

Operation

1 Direct function setup—— Parameter, frequency, display and range :

a) Press keys to move the cursor and select one of the four direct functions.

b) Press keys to select.

2 When measurement range is set to Auto, the instrument first estimates if current range is the correct range, if it's the correct range, then the instrument calculates and displays the measurement value, otherwise instrument has to change to the correct range and start measurement again. Therefore, in range Auto mode, one more measurement will be taken if the measurement range has to be changed. So more time is taken in range Auto mode.

3 If a large number of devices under test belong to the same range, the correct range can be locked to raise the measurement speed. For the instrument do not have to take any time to find the correct the range.

4 When measurement range is set to Hold, if the impedance under test exceeds the effective measuring range of the locked measurement range, overload symbols

5. How to calculate the measurement range

Example: Suppose capacitance C=210pF, dissipation D=0.0010 and test frequency f=1KHz.

Solution:We can calculate: $Zx = 757.9$

Indirect Functions Setup :

Indirect functions are Clear "0", Sorting, Auto-LCZ, Buzzer, Change cursor, Advanced set, and State save & exit.

Press Setup key to enter the setup menu in measurement state. Pressing Setup key again, the instrument returns back to the measurement state.

3. Procedure:

a. Measurement of Resistance using LCR meter:

     i. Select the Resistor.
     ii. Put the LCR meter in Resistace measurement mode.
     iii. Connect the resistor terminals to the LCR probes.
     iv. Tabulate the LCR reading and compare the resistance value with the color coded value.

b. Measurement of capacitance using LCR meter:

     i. Select the capacitor.
     ii. Put the LCR meter in capacitance measurement mode.
     iii. Connect the capacitor terminals to the LCR probes.
     iv. Tabulate the LCR reading and compare the capacitance value with the marked value.
     v.

c. Measurement of Inductance using LCR meter:

     i. Select the Inductor.
     ii. Put the LCR meter in Inductance measurement mode.
     iii. Connect the inductor terminals to the LCR probes.
     iv. Tabulate the LCR reading and compare the inductance value with the marked value.

4. Observations:

S.No	Resistance value		Remarks
	As per color code/marked value	As per LCR meter	

S.No	Capacitance value		Remarks
	As per color code/marked value	As per LCR meter	

S.No	Inductance value		Remarks
	As per color code/marked value	As per LCR meter	

5. ***Precautions:***

(a) ***Procedural precautions:***

- Ensure that all the equipment is disconnected from mains before making connections.

- Ensure the correct range of meters.

- Ensure that there are no loose connections.

- Get the connections checked by the concerned staff member.

(b) *Safety Precautions:*

- Never work on the circuit when power is applied.

- Do not connect power to the circuit until the circuit is finished and you have carefully checked your work.

- If you smell anything burning, immediately disconnect the power and examine your circuit to find out what went wrong.

- Keep your work area dry.

DIGITAL IC TESTER

1. OBJECTIVE: To test an IC using Digital IC tester

2. Description

The setup for this experiment requires the following equipment

NAME OF THE EQUIPMENT/ COMPONENT	Specifications/ Range	No	Purpose
Digital IC Tester		1	For Testing the digital ICs
ICs	7400, 7408, 7432, 7436 etc.,	1	To check their status

3. Theory:

The main component of each and every electronic circuit can be used for wide variety of purposes and functions. But sometimes due to faulty ICs the circuit doesn't work. Indeed it is lot tedious work to debug the circuit and confirm whether the circuiting is creating the problem or the IC itself is dead. So to come up with these sorts of problems IC tester confirm whether the IC under consideration is working properly or not

The purpose of the Digital IC tester is to simply identify and test the condition of digital IC if it is good or defective. An IC tester can be applied to any type of digital ICs. The IC is inserted into the socket and the IC number is entered using the keyboard, showing the number on the 7-segment display unit. The IC number is communicated to other MCU which basically test the ICs for few sets of input which is given through the MCU and corresponding output

Digital IC tester functionally tests a wide variety of digital ICs up to 40 pins

4. PROCEDURE:-

1. Insert the IC in ZIF socket by orienting IC top with the ZIF top.
2. Lock the IC using the lever given in the ZIF socket.
3. Ensure that the IC is inserted properly.
4. Switch ON the IC tester.
5. Check for "-HELLO" message displayed on IC tester.
6. Enter the IC number using the data input keys or numeric keys.
7. Check the status of IC by pressing ENTER key.
8. Remove the IC by unlocking the lever.
9. Place another IC for testing and follow steps 4 to 7.
10. Press AUTO FIND key on IC tester to know the IC number.

6. OBSERVATIONS:-

Static characteristics:-

S.NO	IC number	Status

.

9. PRECAUTIONS:

A. Procedural precautions

11. Ensure that the IC is inserted properly.
2. Don't apply pressure to insert IC in socket.
3. Lock the IC using lever.

B. Safety precautions:

1. 1. The IC should be properly placed on IC tester.
2. .Handle the IC tester with care.

DIGITAL FREQUENCY METER

1. Description

The setup for this experiment requires the following equipment

S.NO	NAME OF THE COMPONENT	RANGE	QUANTITY	PURPOSE
1	Function generator	0-100 MHz	1	For providing signal
2	Digital frequency meter	(0-30)V MC	1	To measure output voltage
3	Connecting wires		required number	To Interconnect the components

2.Circuit diagram
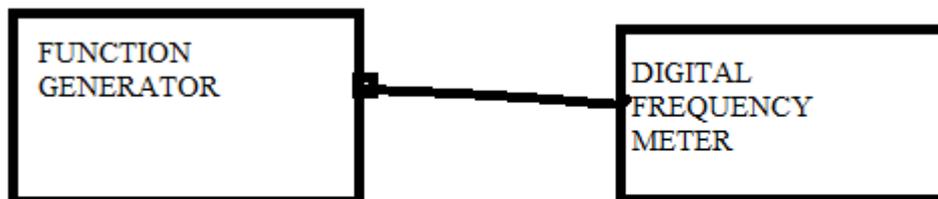
3.Theory

Block diagram of digital frequency meter

The signal whose frequency we have to be measured is first to be amplified through amplifier. The output of amplifier is applied to the Schmitt trigger. The Schmitt trigger is convert input signal into a square wave which has a fast rise and fall time. The square wave is then differentiated and clipped. Each pulse is proportional to each cycle of unknown signal. Now the output from Schmitt

trigger is applied to a start and stop gate. The input pulses are allowed to pass through it, when the gate is open. The counter starts to count these pulses. The gate is closed the output pulses are not allowed to pass through the gate. The counter stops the counting. When the gate is open the number of pulse are counted by the counter. The interval between start and stop condition is the frequency of unknown signal which has to be measured.

$$F = N/t$$

Where,

F = Unknown frequency.

N = Number of counts.

t = Time interval between start and stop condition of the gate.

4. Procedure

1. Connect the circuit as per circuit diagram

2. SWITCH-ON the supply

3. Vary the frequency in function generator.

4. Observe that frequency in frequency meter

5. Observations

S.NO	Input frequency	Output frequency
1		
2		
3		
4		

6. Precautions:

A. Procedural precautions

- Disconnect all the equipment from mains before making connections
- Connect the circuit as per the circuit diagram
- Ensure the correct range meters
- Check for polarity
- Get the connections checked by the concerned staff member
- Ensure that there are no loose connections
- Equipment should be handled carefully

B. Safety precautions

- Never make connections on a circuit when supply is in ON position

- If you smell anything burning, immediately disconnect the power and examine your circuit to find out what went wrong.

- Keep your work area dry

- Always wear safety goggles

Verification of Series Resonance

1. **Description**

   The setup for this experiment requires the following equipment

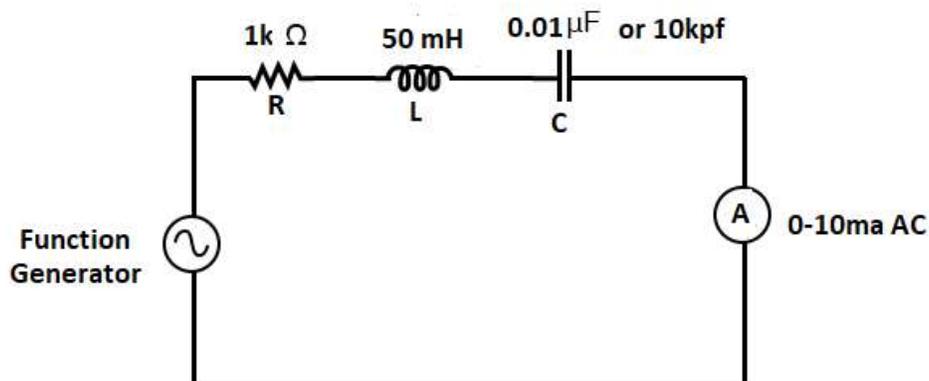| S.No	Name of the Apparatus	Type	Range	Quantity	
1	Function Generator	-		1 No	Input supply
2	Ammeter	MI	0-10 mA	1 No	To measure current
3	Voltmeter or Digital Multimeter	MI	0-10V	1 No	To measure input voltage
4	**Resistor**	Carbon	1KΩ	1 No	Limiting Resistor
5	DC**B**			1 No	Used as a capacitor
6	DIB			1 No	Used as an inductor
7	Bread Board			1 No	To make connections
	Connecting wires	-		Required No	

2. **Circuit diagram**

Fig. Series resonant circuit

2. **Theory**

   The resonance of a series RLC circuit occurs when the inductive and capacitive reactance are equal in magnitude but cancel each other because they are 180 degrees apart in phase. The impedance of an RLC series circuit at resonance is simply R.

   The voltage across the capacitor and the voltage across the inductor are equal, so the circuit looks like a resistor. No energy is dissipated at resonance. The current in the circuit can be measured with a meter or, we could calculate the current using a form of Ohm's law, which is – current *(I)* equals the applied voltage *(E)* divided by impedance or total opposition in the circuit *(Z)*, i.e. *Current = Voltage/Impedance,* I = E/Z. A series-resonant circuit offers low impedance to the flow of current at a particular frequency.

   The circuit is said to be resonant when the frequency of the applied voltage is adjusted to produce maximum current while the magnitude of the voltage is held constant. The frequency of this voltage and current is called the **resonant frequency**, and is defined as the frequency at which a given system or object will respond with maximum amplitude.

Impedance

In the series RLC network the **impedance** is defined by the equation:

   This takes into account the opposition of the resistor (*resistance R*), the opposition of the inductor (*inductive reactance or X_L*), and the opposition of the capacitor (*capacitive reactance or X_C*). As shown in the graph below, the impedance of an AC circuit varies with frequency. Inductive reactance is directly proportional to frequency, if the frequency being applied to the circuit is increased there would be an increase in X_L. Capacitive reactance on the other hand is inversely proportional to frequency so, as the frequency increases the value of X_C decreases. The relationship between frequency and reactance are expressed by the equations:

Series Resonance — Impedance vs. Frequency.
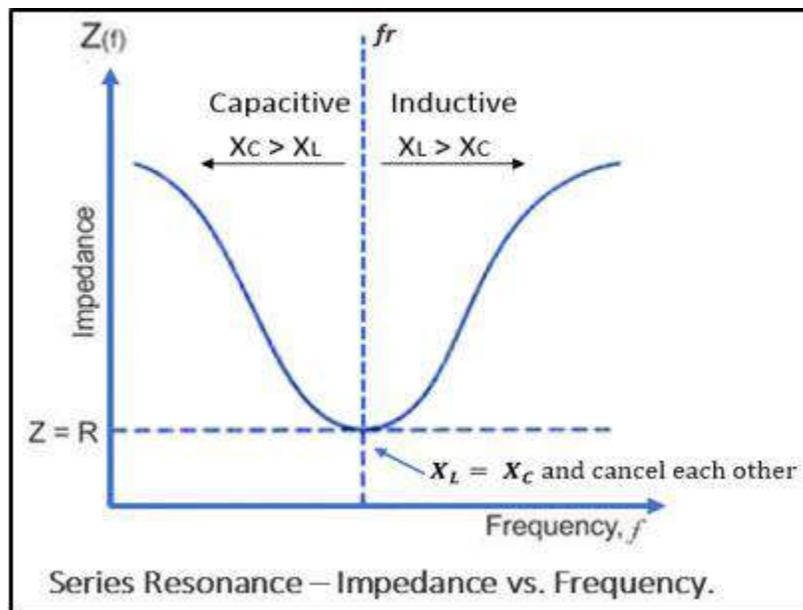
At the lower frequency most of the opposition is X_C or capacitive reactance and at the higher frequencies the opposition is mainly X_L or inductive reactance. At **resonant frequency (f_r)** the inductive and capacitive reactances cancel each other out, leaving only the resistance to oppose the flow of current. When the circuit has equal values of inductive reactance and capacitive reactance, it tends to reject signals having frequencies removed from the resonant frequency. In other words, it will reject signals that are either above or below the frequency that produces resonance. Therefore, in resonant circuits, certain signals are selected to pass through while others are rejected, or blocked and this signal is referred to as a bandwidth of frequencies.

Bandwidth

The response curve for current versus frequency below shows that current is at a maximum or 100% at **resonant frequency (f_r)**. The **bandwidth (BW)** of a resonant circuit is defined as the total number of cycles below and above the resonant frequency for which the current is equal to or greater than 70.7% of its resonant value. The two frequencies in the curve that are at 0.707 of the maximum current are

called band, or half-power frequencies. These frequencies are identified on the curve as f1 and f2, and

are often referred to as the critical frequencies, or cut-off frequencies, of a resonant circuit.

Calculation of Frequency: At resonance

$$X_L = X_C \quad \Rightarrow \quad 2\pi f L = \frac{1}{2\pi f C}$$

$$f^2 = \frac{1}{2\pi L \times 2\pi C} = \frac{1}{4\pi^2 LC}$$

$$f = \sqrt{\frac{1}{4\pi^2 LC}}$$

$$\therefore f_r = \frac{1}{2\pi \sqrt{LC}} \text{ (Hz)} \quad \text{or} \quad \omega_r = \frac{1}{\sqrt{LC}} \text{ (rads)}$$
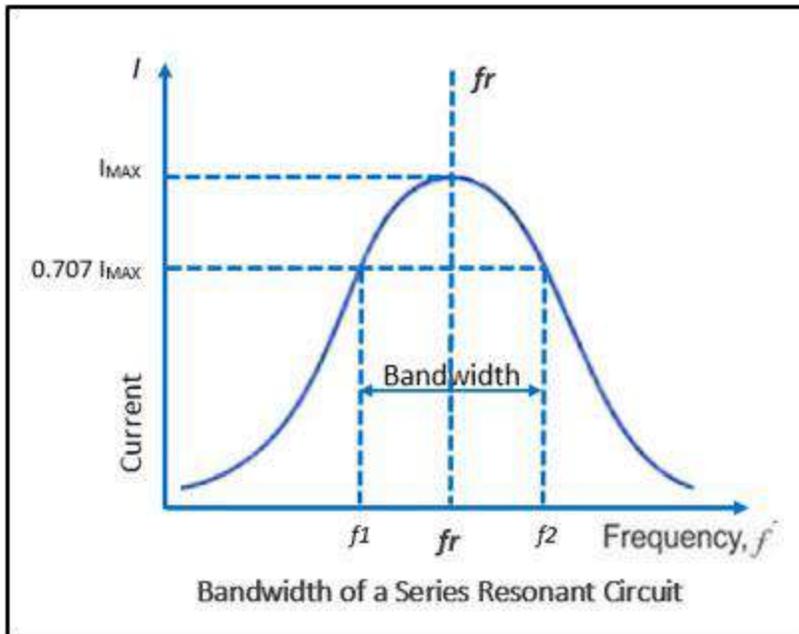
4. Procedure:
1. Connect the circuit as shown in figure.
2. Set the Inductance value on DIB   Ex: L=50 mH.
3. Set the capacitance value on DCB   Ex :C= 0.01μF or 10kpF
4. Switch on the power supply.
5. Select the sine function in function generator
6. Set the input voltage at   ---- Volts.Ex:6V
7. Vary the frequency in steps of   ------ (ex: 1KHz) note down the corresponding ammeter readings.
8. Tabulate the readings
9. Plot the graph by taking frequency on x-axis and current on y-axis.
10. By locating the peak position of the graph, the resonance frequency of series LCR circuit can be deduced.
11. Compare the observed frequency with the theoretical frequency.

5. Observations

S.No	Frequency in Hz	Current (I) in mA
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		

6. Model Graph

Bandwidth of a Series Resonant Circuit

Theoretical Calculations

$$\therefore f_r = \frac{1}{2\pi \sqrt{LC}} \text{ (Hz)} \quad \text{or} \quad \omega_r = \frac{1}{\sqrt{LC}} \text{ (rads)}$$

EX: L=50 mH,   C= 0.01µF f_r=7.1KHz

7. Interpretation of results

     It is observed that current is maximum at series resonance.

8. Precautions:

1. Initially keep the signal generator output voltage knob in zero volt position
2. If the pointer in ammeter is not in zero position, set the pointer at zero position.
3. Take the readings without parallax error.
4. Avoid loose connections.

9. Need and scope of the experiment:

The high value of current at resonance produces very high values of voltage across the inductor and capacitor. Series resonance circuits are useful for constructing **highly frequency selective filters**. ... Because impedance is minimum and current is maximum, series resonance circuits are also called Acceptor Circuits.A series resonant circuit **provides voltage magnification**. This effect is most useful for tuning a radio, where the desired signal is allowed to pass through to the next stage in the radio, without allowing other signals to get through as they are effectively shorted out before reaching the rest of the radio circuitry.

Verification of Parallel Resonance

1. **Description**

   The setup for this experiment requires the following equipment

S.No	Name of the Apparatus	Type	Range	Quantity	
1	Function Generator	-		1 No	Input supply
2	Ammeter	MI	0-10 mA	1 No	To measure current
3	Voltmeter or Digital Multimeter	MI	0-10V	1 No	To measure input voltage
4	**Resistor**	Carbon	1KΩ	1 No	Limiting Resistor
5	DC**B**			1 No	Used as a capacitor
6	DIB			1 No	Used as an inductor
7	Bread Board			1 No	To make connections
	Connecting wires	-		Required No	

2. **Circuit diagram**

Fig. Parallel Resonant Circuit

3. **Theory**

   A parallel circuit containing a resistance, R, an inductance, L and a capacitance, C will produce a **parallel resonance** (also called anti-resonance) circuit when the resultant current through the parallel combination is in phase with the supply voltage. At resonance there will be a large circulating current between the inductor and the capacitor due to the energy of the oscillations, then parallel circuits produce current resonance.

   Then there are two methods available to us in the analysis of parallel resonance circuits. We can calculate the current in each branch and then add together or calculate the admittance of each branch to find the total current.

   resonance takes place when V_L = $-V_C$ and this situation occurs when the two reactances are equal, $X_L = X_C$. The admittance of a parallel circuit is given as:
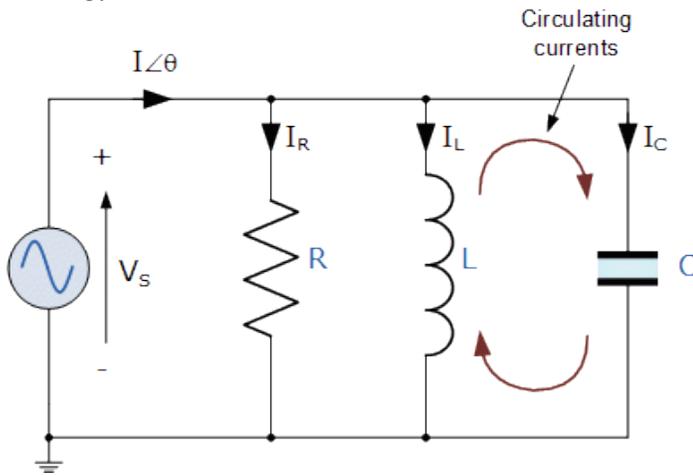
$$Y = G + B_L + B_C$$

$$Y = \frac{1}{R} + \frac{1}{j\omega L} + j\omega C$$

or

$$Y = \frac{1}{R} + \frac{1}{2\pi f L} + 2\pi f C$$

Resonance occurs when $X_L = X_C$ and the imaginary parts of Y become zero. Then:

$$X_L = X_C \quad \Rightarrow \quad 2\pi f L = \frac{1}{2\pi f C}$$

$$f^2 = \frac{1}{2\pi L \times 2\pi C} = \frac{1}{4\pi^2 LC}$$

$$f = \sqrt{\frac{1}{4\pi^2 LC}}$$

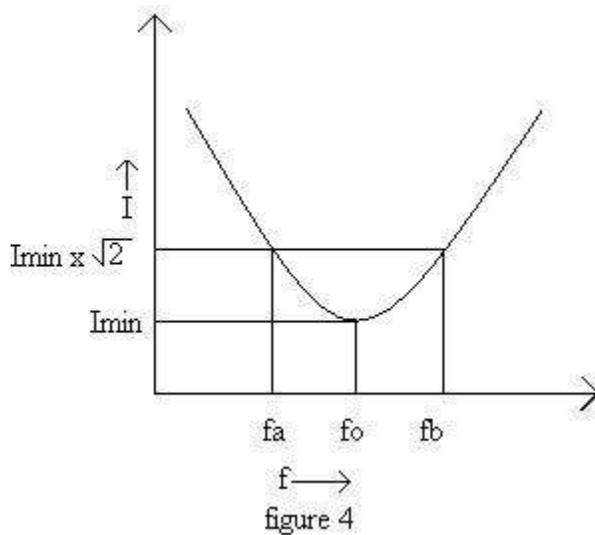$$\therefore f_r = \frac{1}{2\pi \sqrt{LC}} \, (\text{Hz}) \quad \text{or} \quad \omega_r = \frac{1}{\sqrt{LC}} \, (\text{rads})$$

At resonance the parallel LC tank circuit acts like an open circuit with the circuit current being determined by the resistor, R only. So the total impedance of a parallel resonance circuit at resonance becomes just the value of the resistance in the circuit and Z = R

4. Procedure:
1. Connect the circuit as shown in figure.
2. Set the Inductance value on DIB   Ex:L=50 mH.
3. Set the capacitance value on DCB   Ex:C= 0.01µF or 10kpF
4. Switch on the power supply.
5. Select the sine function in function generator
6. Set the input voltage at ---- Volts.Ex:6V
7. Vary the frequency in steps of   ------(ex:1KHz) note down the corresponding ammeter readings.
8. Tabulate the readings
9. Plot the graph by taking frequency on x-axis and current on y-axis.
10. By locating the resonant position of the graph, the resonance frequency of parallel LCR circuit f_r can be deduced.
11. Compare the observed frequency with the theoretical frequency.

5. Observations

S.No	Frequency in Hz	Current (I) in mA
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		

6. Model Graph

figure 4

Theoretical Calculations

$$\therefore f_r = \frac{1}{2\pi\sqrt{LC}} \text{ (Hz)} \quad \text{or} \quad \omega_r = \frac{1}{\sqrt{LC}} \text{ (rads)}$$

EX: L=50 mH,   C= 0.01µF f_r=7.1KHz

7. Interpretation of results

It is observed that current is minimum at parallel resonance.

8. Precautions:

1. Initially keep the signal generator output voltage knob in zero volt position
2. If the pointer in ammeter is not in zero position, set the pointer at zero position.
3. Take the readings without parallax error.
4. Avoid loose connections.

9. Need and scope of the experiment:

A Parallel resonant circuit **provides current magnification**. It can be used as load impedance in output

circuits of RF amplifiers. It can be used in Induction heating.

Thevenin's theorem

Objective: To verify Thevenin's Theorem

1. Description

The setup for this experiment requires the following equipment

S.No	Name of the Apparatus	Type	Range	Quantity
1.	Regulated Power Supply (RPS)	-	0-30 V	1 No
2.	Voltmeter	MC	0-10 V	1 No
3.	Ammeter	MC	0-10 m A	1 No
4.	Resistors	Carbon composition	2.2 k Ω , 100 Ω, 1 k Ω	Each one No Each two No's
5.	Decade resistance box	-	0-1 k Ω	1 No
6.	Bread Board	-	-	1 No
7.	Connecting wires	-	-	Required No

2. Circuit diagram

Given Circuit:
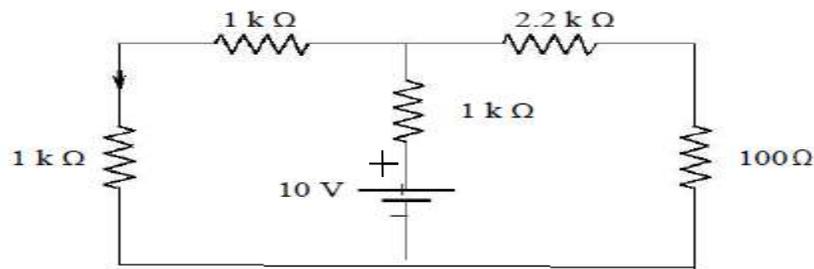
Fig 1.1

Practical circuit Diagrams:

(a) To Find Load Current I_L
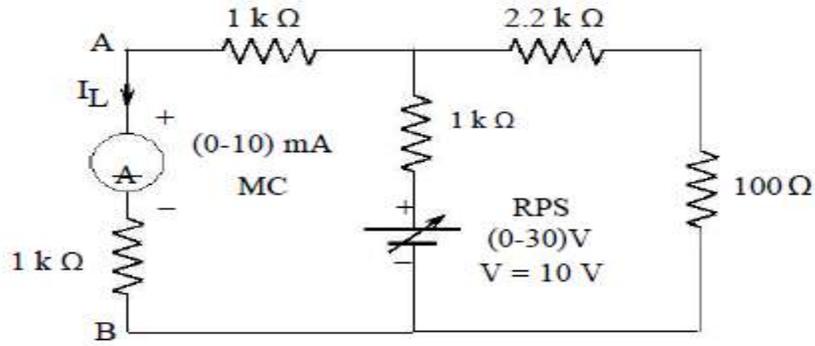
Fig 1.2

(b) To Find V th
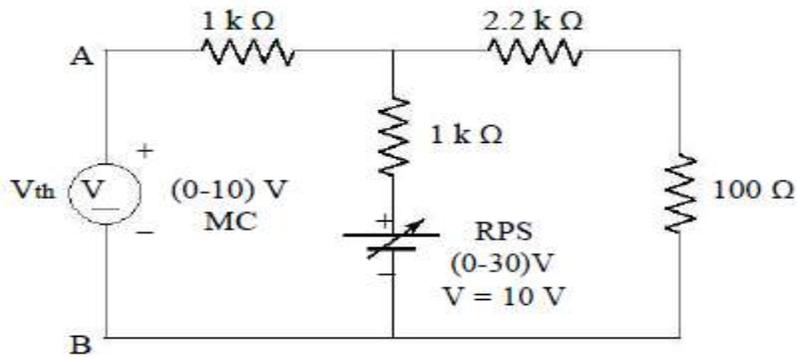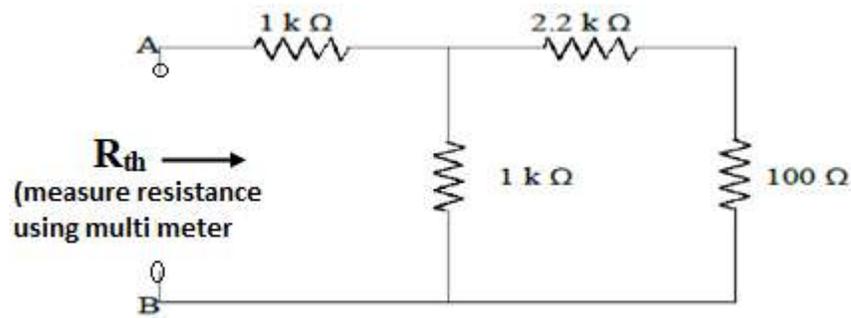

Fig 1.3

(c) To Find R th :

Fig. 1.4

(d) To find Load Current I'_L Using Thevenin's Equivalent Circuit:
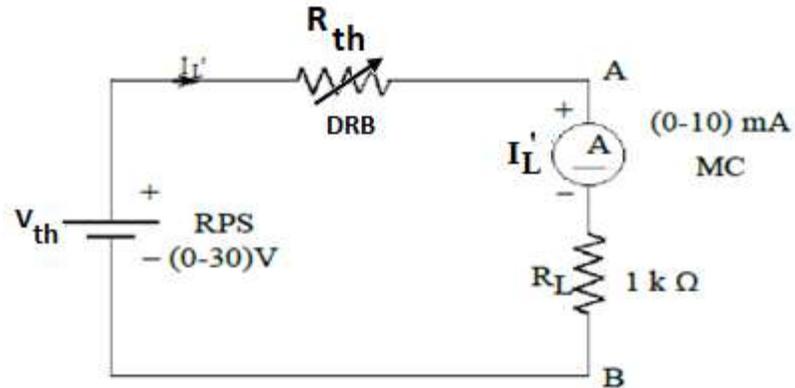
Fig 1.5

3. Theory

Statement :

It states that any linear, active network with two open terminals can be replaced by an equivalent circuit consists of Thevenin's equivalent voltage source V_{th} in series with Thevenin's equivalent resistance R_{th}.

To find a current ' I_L' through load resistance R_L connected across load of a linear network. The following steps are followed.

Step-1 : Find V_{th} across load terminals by removing R_L.

Step-2 : Find R_{th} by removing R_L viewed from load terminals.

Step-3: Now current, $I_L = \dfrac{V_{th}}{R_{th} + R_L}$

4. Procedure:

- Connect the circuit as per Fig 1.2.

- Swith 'ON' the supply

- Adjust the output voltage of the RPS to 10 V

- Note down the response (Current, I_L) through the branch of interest i.e., AB (Ammeter reading).

- Reduce the RPS output voltage to 0 V and 'Switch OFF' the supply.

- Disconnect the circuit and connect as per the Fig. 1.3.

- Adjust the RPS output voltage to 10 V.

- Note down the voltmeter reading (Voltage across the load terminals A and B) that gives V_{th}.

- Reduce the RPS output voltage to 0 V and Switch 'OFF' the supply.

- Disconnect the circuit and connect as per the Fig. 1.4.

- Measure the R_{th} value across AB using multi-meter.

- Disconnect the circuit and connect as per the Fig. 1.5.

- Adjust the RPS output voltage to the Thevenin's equivalent voltage, Vth.

- Set the measured Rth value in DRB

- Note down the ammeter reading (Current, I_L' through the branch AB).

- Reduce the RPS output voltage to 0 V and switch 'OFF' the supply.

- Disconnect the circuit.

- Check whether the current I_L through the load resistor R_L in circuit 1.2 and the load current I_L' in circuit 1.5 are equal or not.

Theoretical calculations:

(a) To Find Load Current I_L :
       Apply K.V.L to loop-1

$$10 = 1 \text{ k } [I_1 + I_2] + 2 \text{ k } I_1$$
$$10 = 3 \text{ k } I_1 + 1 \text{ k } I_2 \qquad\qquad (1)$$

Apply K.V.L to Loop-2

$$10 = 1 \text{ K } [I_1 + I_2] + 2.3 \text{ K } I_2$$
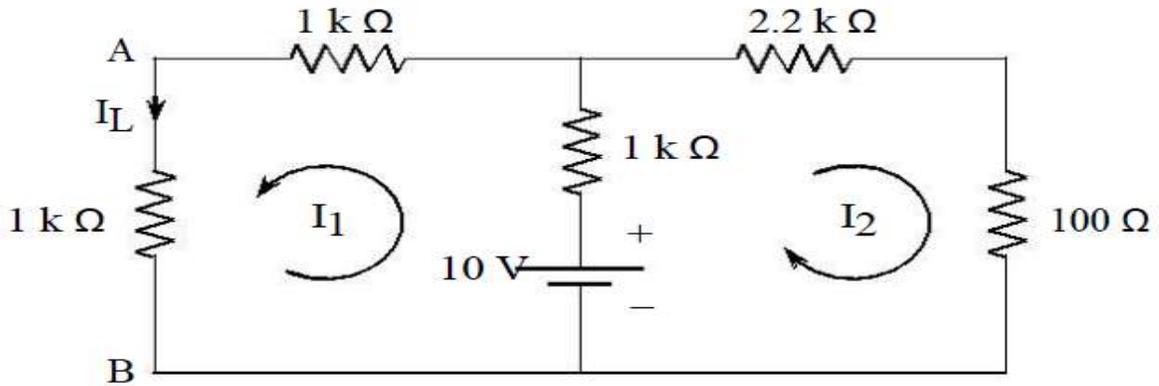$$10 = 3.3 \text{ K} I_2 + I \text{ K } I_1 \qquad\qquad (2)$$

Fig .1.6

In matrix form

$$\begin{bmatrix} 3000 & 1000 \\ 1000 & 3000 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} 10 \\ 10 \end{bmatrix}$$

$$I_1 = \frac{\Delta_1}{\Delta} = 2.58mA$$

$$I_2 = \frac{\Delta_2}{\Delta} = 2.25mA$$

Hence, $I_L = I_1 = 2.58\ mA$

(**b**)To find V_{th} :

$$I = \frac{10}{3300} = 3.03\ mA$$

V_{th} =10 -1k ×3.03× 10⁻³ = 6.96 V.
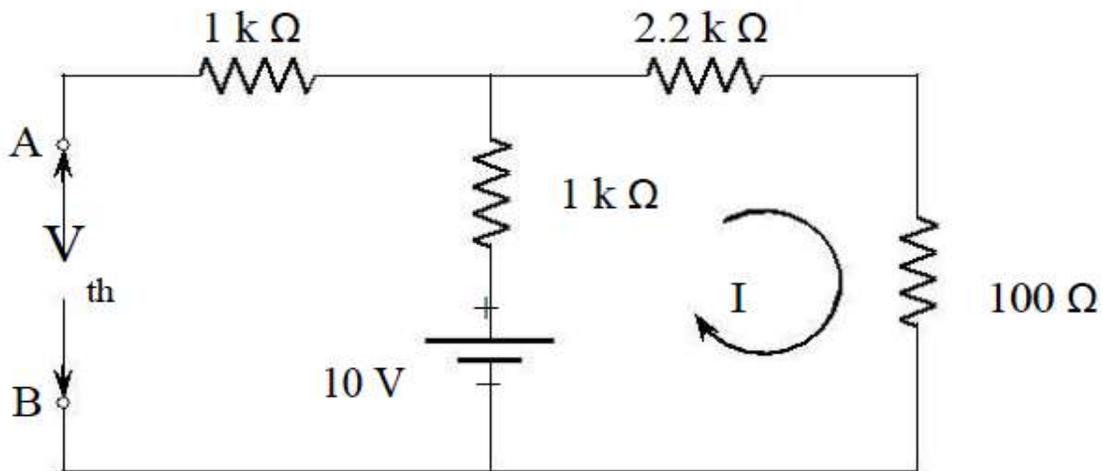

Fig. 1.7

(c) to find R_th :

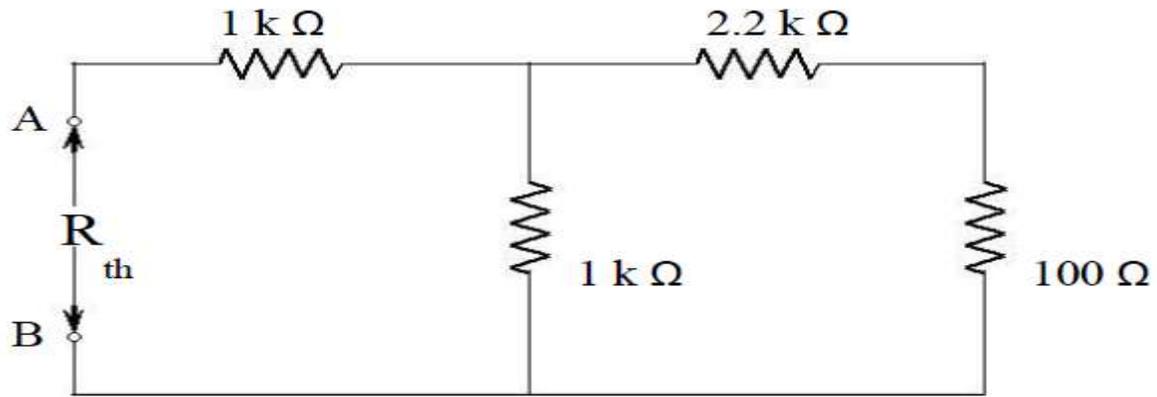$$R_{th} = 1\,K + (\frac{1K*2300}{1\,K+2300}) = 1696.96\ \Omega$$

Fig 1.8

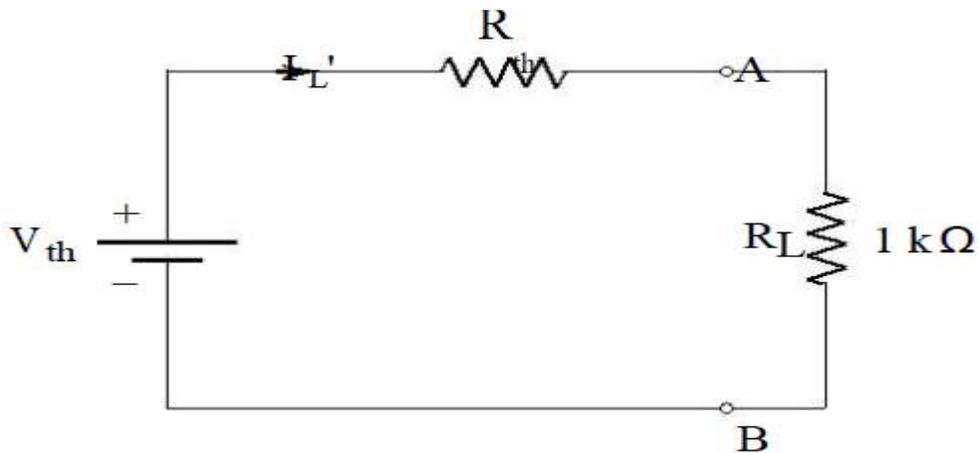(d) To Find Load Current $I'_L = \dfrac{V_{th}}{R_{th}+R_L} = 2.58\ mA$

Fig 1.9

5. Observations:

(a) To find Load current I_L :

S. No	Source (or) Applied Voltage , V_S(Volt)	Current I_L(mA)

(b) To Find V_{th} :

S. No	Source Voltage , V_S(Volt)	Thevenins equivalent voltage V_{th} (Volt)

(c) To find R_{th} :

Rth measured using multi-meter in ohms=

(d) To find Load current I_L' using Thevenins Equivalent Circuit:

S. No	Thevenins equivalent voltage V_{th} (Volt)	Current I_L' (mA)

- Comparison between theoretical and practical values

S.No	Parameter	Theoretical Values	Practical Values
1	V_{th}	6.96 V	--------- V
2	R_{th}	1696.96 Ω	--------- Ω
3	Load Current	2.58 mA	--------- mA

Precautions:

1. Initially keep the RPS voltage knob in zero volt position.

2. Set the ammeter pointer at zero position.

3. Set the RPS current control knob at some position.

4. Take the readings without parallax error.

5. Avoid loose connections.

5. Do not short-circuit the output terminals of the R.P.S.

Verification of super position theorem

Objective : To verify Super Position Theorem

1. **Description**
   The setup for this experiment requires the following equipment

S.No	Name of the Apparatus	Type	Range	Quantity
1	Regulated Power Supply (RPS)	-	0-30 V	1 No
2	Ammeter	MC	0-10 mA	1 No
3	Resistors	Carbon composition	4.7 k Ω , 1.8 k Ω and 1 k Ω	Each one No
4	Bread board	-	-	1 No
5	Connecting wires	-	-	Required No

2. **Circuit diagram**
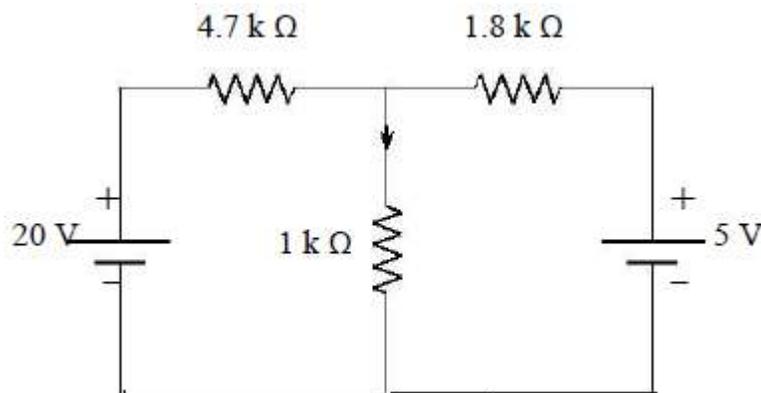

Fig 1.1

Practical circuit diagrams:

(a) When both sources are acting:
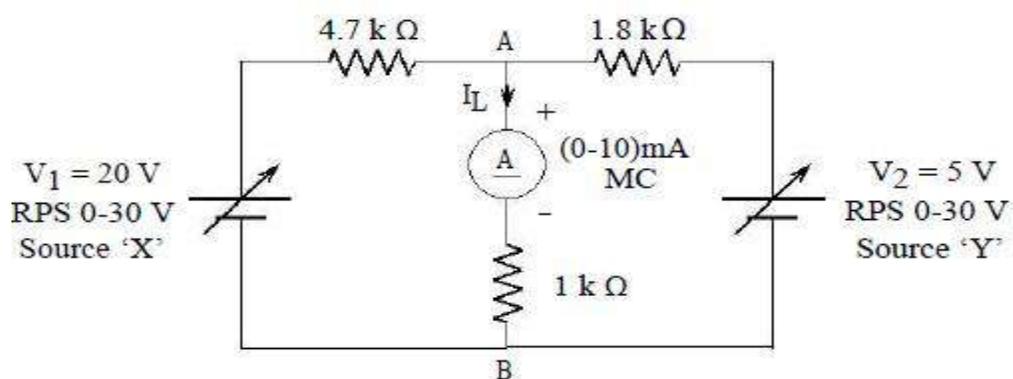

Fig. 1.2

(b) When 20 V source is acting alone:
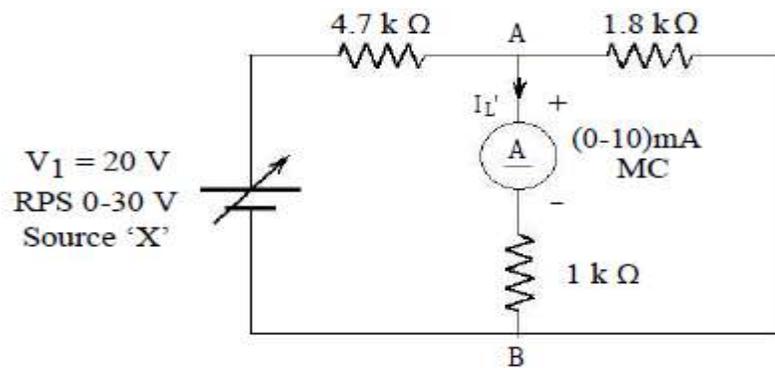

Fig. 1.3

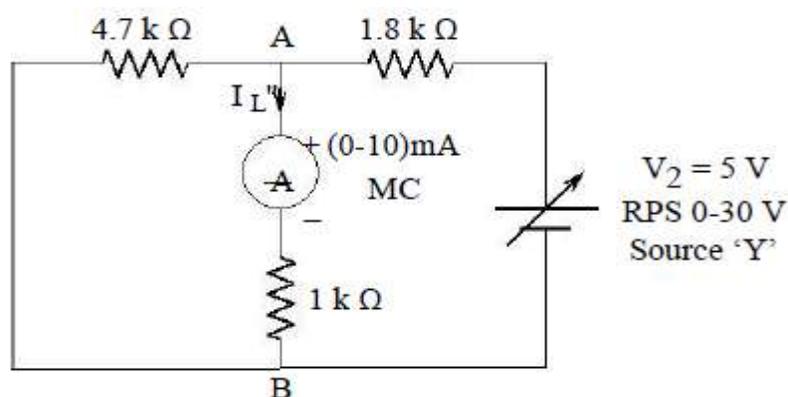**(c) When 5 V source is acting alone :**

Fig. 1.4

3. Theory

Statement:

In any linear, bilateral multisource network the response (voltage or current) in any element is equal to the algebraic sum of the responses caused by each source acting alone while all other independent sources are replaced by their internal impedances.

If the internal impedances of the sources are unknown then the independent voltage sources must be replaced by short circuit while the independent current sources must be replaced by an open circuit.

Note: The suspension theorem does not apply to the power as power is proportional to square of the current, which is not a linear function.

4. Procedure:

1. Make the connections as per circuit diagram

2. Switch 'ON' the supply.

3. Adjust the output voltage of sources 'X' and 'Y' to 20 V and 5 V respectively

4. Note down the response (current, I_L) through the branch of interest i.e., AB (Ammeter reading).

5. Now set the voltage source 'X' to 20 V and source 'Y' to 0 V.

6. Note down the ammeter reading (current, I $_L'$).

7. Now set the voltage source 'Y' to 5 V and source 'X' to 0 V.

8. Notedown the corresponding ammeter reading (current, I $_L''$).

9. Reduce the output voltage of the sources 'X' and 'Y' to 0 V and switch 'OFF' the supply.

10. Disconnect the circuit.

Theoretical calculations:
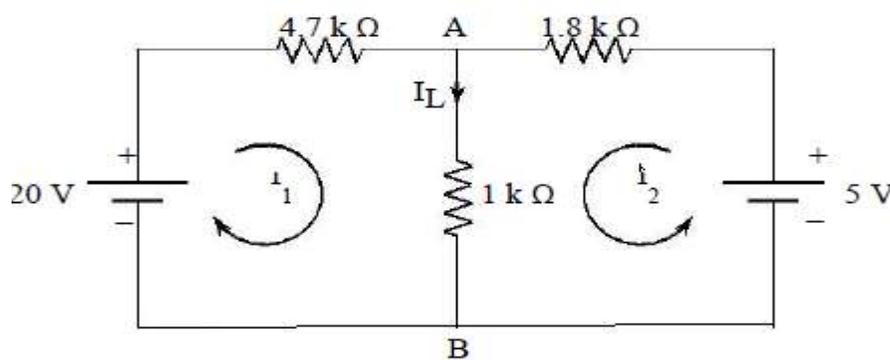
(a) When both the sources are acting alone :

Fig 1.5

Apply K.V.L. to loop 1,

$$20 = 4.7K\,I_1 + 1\,K\,(I_1 + I_2)$$

$$20 = 5.7KI_1 + 1\,K\,I_2 \qquad\qquad \text{............ (1)}$$

Apply K.V.L to loop 2,

$$5 = 1.8KI_2 + 1\,K\,[I_1 + I_2]$$

$$5 = 2.8KI_2 + 1\,K\,I_1 \qquad\qquad \text{............ (2)}$$

$$\begin{bmatrix} 5700 & 1000 \\ 1000 & 2800 \end{bmatrix}\begin{bmatrix} I_1 \\ I_2 \end{bmatrix}=\begin{bmatrix} 20 \\ 5 \end{bmatrix}$$

$$I_1 = \frac{\Delta_1}{\Delta} = 3.41 \; mA$$

$$I_2 = \frac{\Delta_2}{\Delta} = 0.57 mA$$

$$I_L = I_1 + I_2 = 3.41 + 0.57 = 3.98 mA$$

(b) When 20V source is acting alone

Apply K. V. L to loop 1

Apply K.V.L to loop 1

$$20 = 4.7KI_1 + 1\,K\,[I_1 + I_2]$$

$$20 = 5.7K\,I_1 + 1\,KI_2............ \qquad\qquad \text{(1)}$$

Apply K.V.L. to loop 2

$$0 = 1.8K\,I_2 + 1\,K\,[I_1 + I_2]$$

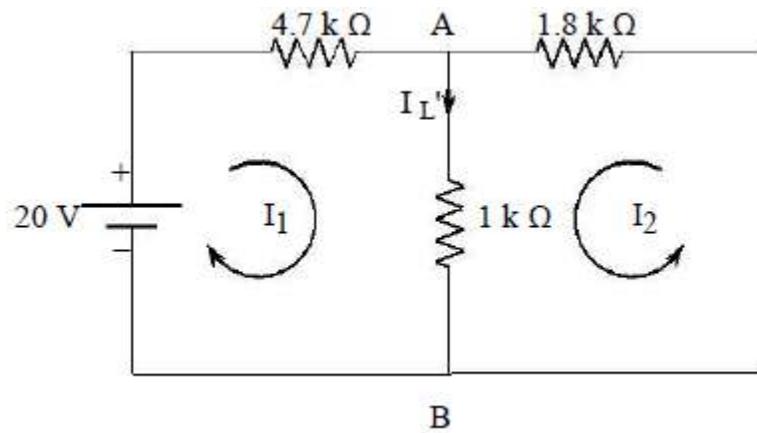$$0 = 2.8K\,I_2 + 1\,K\,I_1............ \qquad\qquad \text{(2)}$$

Fig. 1.6

$$\begin{bmatrix} 5700 & 1000 \\ 1000 & 2800 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} 20 \\ 0 \end{bmatrix}$$

$$I_1 = \frac{\Delta_1}{\Delta} = 3.74 \ mA$$

$$I_2 = \frac{\Delta_2}{\Delta} = -1.34 \ mA$$

$$I_L' = I_1 + I_2 = 3.74 - 1.34 = 2.4 \ mA$$

(c)When 5 V source is acting alone:
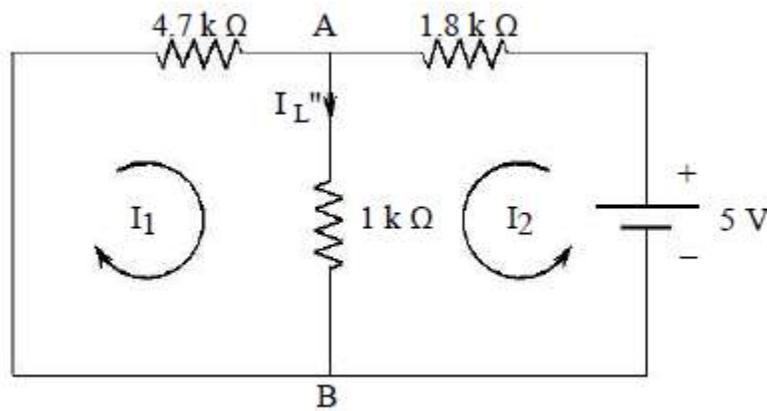
Fig. 1.7

$$0 = 4.7 \ KI_1 + 1 \ K \ [I_1 + I_2]$$

$$0 = 5.7 \ K \ I_1 + 1 \ KI_2 \qquad\qquad \text{..............} \qquad (1)$$

Apply K.V.L to loop 2,

$$5 = 1.8 \ K \ I_2 + 1 \ K \ [I_1 + I_2]$$

$$5 = 2.8 \ K \ I_2 + 1 \ K \ I_1 \qquad\qquad \text{..............} \qquad (2)$$

In matrix form

$$\begin{bmatrix} 5700 & 1000 \\ 1000 & 2800 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} 0 \\ 5 \end{bmatrix}$$

$$I_1 = \frac{\Delta_1}{\Delta} = -0.33 \ mA$$

$$I_2 = \frac{\Delta_2}{\Delta} = 1.91 \ mA$$

$$I_L'' = I_1 + I_2 = 1.58 \ mA$$

Verify, $I_L = I_L' + I_L''$

5. Observations:

- When both the sources are acting alone:

S.No	Applied Voltage		Current
	V_1(Volts)	V_2(Volts)	I_L(mA)

- When 20V source is acting alone

S. No	Applied Voltage V_1 (volts)	Current I'_L (mA)

- When 5 V source is acting alone:

S. No	Applied Voltage V_2 (volts)	Current I''_L (mA)

Verify,

- Comparison between theoretical and practical values

S.No	Load current	Theoretical Values	Practical Values
1.	When Both sources are acting, I_L	3.98 mA	_____ mA
2.	When only source 'X' is acting I_L'	2.4 mA	_____ mA
3.	When source 'Y' is acting, I_L''	1.58 mA	_____ mA

Precautions:

1. Initially keep the RPS output voltage knob in zero volt position.

2. Set the ammeter pointer at zero position.

3. Take the readings without parallax error.

4. Avoid loose connections.

5. Avoid short circuit of RPS output terminals.

Verification of Maximum Power Transfer Theorem

1. **Description**

The setup for this experiment requires the following equipment

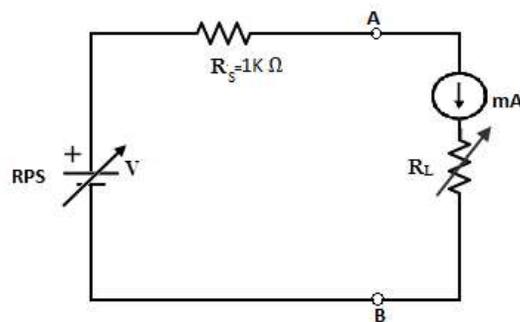| S.No	Name of the Apparatus	Type	Range	Quantity
1	Regulated Power Supply (RPS)	-	0-30 V	1 No
2	Ammeter	MC	0-10 mA	1 No
3	Resistors	Wire wound	1 k Ω	1No.
4	DRB	-	-	1 No
5	Connecting wires	-	-	Required No

2. **Circuit diagram**

Fig Maximum Power Transfer theorem

3. **Theory**

Statement:

Statement: It states that in a linear, bilateral DC network, maximum power is transferred to the load when the load resistance becomes equal to the internal resistance of a source.

Theoretical calculations:
    Input source voltage V=10V
    Source resistance Rs=1000Ω

According to maximum power transfer theorem, maximum power will be delivered to the load when the load resistance R_L is equal to source resistance Rs. Hence the load resistance for maximum power transfer is R_L=1000 Ω
    For this condition the load current I_L is given by

$$I_L = \frac{V}{R_s + R_L}$$

$$I_L = \frac{10}{1000 + 1000} = \frac{10}{2000} = 5mA$$

$$P_L = I^2 R_L$$
$$P_{L(max)} = (5 \times 10^{-3})^2 \times 1000 = 25mW$$

4. Procedure:

1. Make the connections as shown in the circuit.
2. Switch ON power supply and the RPS.
3. Set the input voltage at 10V.
4. Set the DRB resistance i.e R_L at 100 Ω.
5. Note down the ammeter reading i.e load current
6. keeping the input voltage constant, vary the resistance in DRB in steps of 100 Ω and note down the ammeter reading in each step till the the load resistance is 2kΩ.
7. Tabulate the readings and Calculate the power delivered to load using the formula $P_L = I^2R_L$.
8. Plot the graph by taking load resistance on x-axis and power delivered (P_L) on y-axis.
9. From the graph, determine the value of load resistance for which maximum power is delivered.
10. Check whether the load resistance for which maximum power is delivered is equal to the source resistance

5. Observations

Input Source voltage = 10V

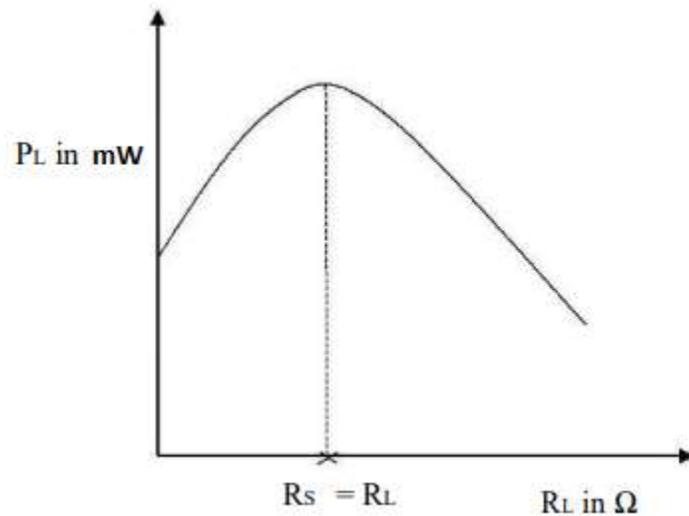| S.No	Load Resistance (R_L) in kΩ	Load current (I_L) in mA	Power delivered $P_L = I^2R_L$ in mW
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			

6. Model Graph

Fig. Load resistance versus power delivered model graph

7. Interpretation of results

It is observed that maximum power is transferred to load from the source when the load resistance is equal to source resistance.

8. Precautions:

1. Initially keep the RPS output voltage knob in zero volt position and current setting knob at middle position.
2. If the pointer in ammeter is not in zero position, set the pointer at zero position.
3. Take the readings without parallax error.
4. Avoid loose connections.
5. Avoid short circuit of RPS output terminals.

9. Need and scope of the experiment:

Maximum power transfer theorem is very much needed while cascading different sections of any circuit. In PA systems the resistance of loud speaker must selected such that its resistance is equal to amplifier's output resistance.

The maximum power transfer theorem can be extended to AC circuits having AC sources and impedances. In this case maximum power will be delivered from ac source to load when the load impedance is complex conjugate of source impedance.

Measurement of AC and DC Voltage using CRO

1. Description:

Name	Specification	Quantity	Purpose
CRO (Dual Channel)	0-20 M Hz	01	For displaying and measuring of waveforms
CRO probe		01	To make the connection to CRO from function generator/RPS
Bread board		01	To develop the circuit
Function Generator (1Hz-1MHz).	1 Hz- 1 MHz	01	To generate AC signals
Regulated power supply	(0-30V)	01	To provide supply voltage
Connecting wires	Red, green, blue, and black. 3/20guage suitable lengths	As per the need	To make the connection and interconnections to equipment

Circuit diagram:

➢ **AC measurement**
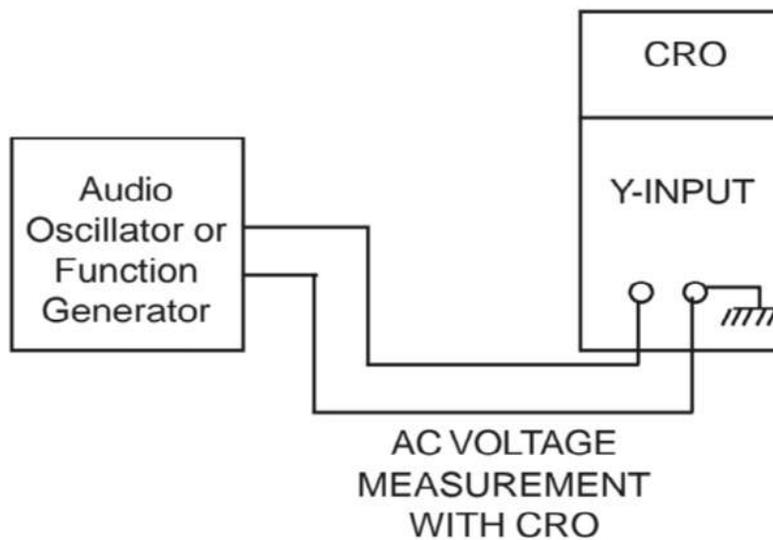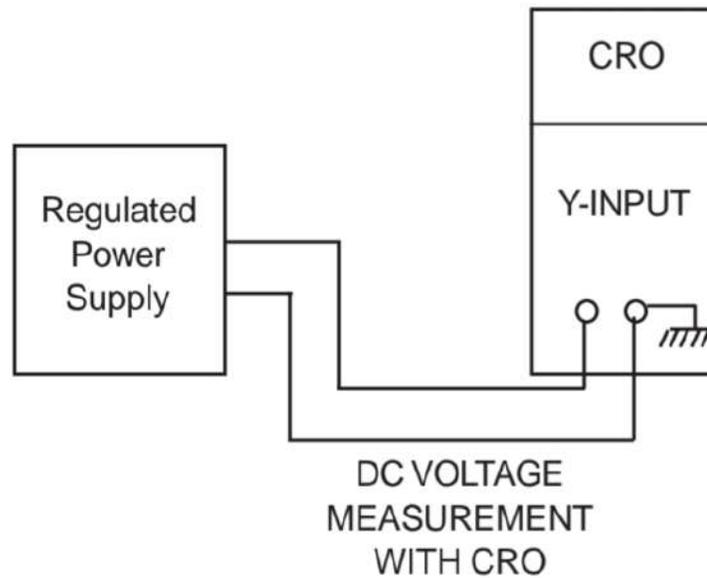
AC VOLTAGE
MEASUREMENT
WITH CRO

➢ **DC Measurement**

DC VOLTAGE
MEASUREMENT
WITH CRO

Theory:

➢ **CRO:**

The cathode-ray oscilloscope (CRO) is a common laboratory instrument that **provides accurate time and amplitude measurements of voltage signals over a wide range of frequencies**. Its reliability, stability, and ease of operation make it suitable as a general purpose laboratory instrument.

➢ **Function Generator:**

A function generator is a piece **of electronic test instrument used to generate and deliver standard waveforms, typically sine and square waves, to a device under test**. It can be used to test a design or confirm that a piece of electronic equipment is working as intended.

➢ **Regulated Power Supply:**

A regulated power supply is **a** device which converts unregulated AC (Alternating Current) into a constant DC. With the help of a rectifier it converts AC supply into DC. The output from the regulated power supply may be alternating or unidirectional, but is nearly always DC (Direct Current).

Procedure:

➢ **AC Measurements**

- Switch on the time base you will observe a horizontal line on the screen.
- Give the AC voltage to be measured to Y input terminals.
- Adjust the frequency and amplitude to get a stable waveform on the screen.
- Note down the selection in volts/div from the front panel.
- Use the following relation to obtain peak to peak value in volts.

$$V_{pp=} \text{ No. of vertical divisions X } \frac{Volts}{Div}$$

- The r.m.s value can be easily calculated from amplitude or peak to peak value if desired.

$$V_{rms} = \frac{V_{pp}}{2\sqrt{2}}$$

➢ **DC Measurements:**

- Switch off the time base you will observe a spot on the screen.
- Adjust X and Y position controls to get the spot on to the centre of the screen
- Set the Y-gain control (volts/div) on 2 V position.
- Give the DC voltage to be measured to Y-input terminals.
- The control spot now gets shifted by 3 divisions , This indicates that the 6V=3×input voltage(2V)

Observations:

➢ **AC measurement**

S No	Input Frequency	No. of vertical divisions	Volts/Div	$V_{pp=}$ No. of vertical divisions X Volts/Div	$V_{rms} = \frac{V_{pp}}{2\sqrt{2}}$
1	0.5 K Hz	2.8	50m	0.14 V	0.049V
2	1 K Hz	5.4	0.5	2.7 V	0.95 V
3	2 K Hz	2.8	1	2.8 V	0.99 V
4	4 K Hz	5.4	2	10.8V	3.8 V
5	6 K Hz	3.4	5	17 V	6 V

➢ **DC measurement**

S No	RPS output (Volts)	No. of vertical divisions	Volts/Div	$V_{DC=}$ No. of vertical divisions X Volts/Div
1	1V	2	0.5	1V
2	2V	2	1	2V
3	3.6V	1.8	2	3.6V
4	10V	2	5	10V
5	14V	2.8	5	14V

Measurement of Pulse parameters using CRO

1. Description:

Name	Specification	Quantity	Purpose
CRO (Dual Channel)	0-20 M Hz	01	For displaying and measuring of waveforms
CRO probe		01	To make the connection to CRO from function generator/RPS
Pulse generator (1Hz-1MHz).	1 Hz- 1 MHz	01	To generate AC signals
Connecting wires	Red, green, blue, and black. 3/20guage suitable lengths	As per the need	To make the connection and interconnections to equipment

Circuit diagram:

Theory:

➢ **CRO:**
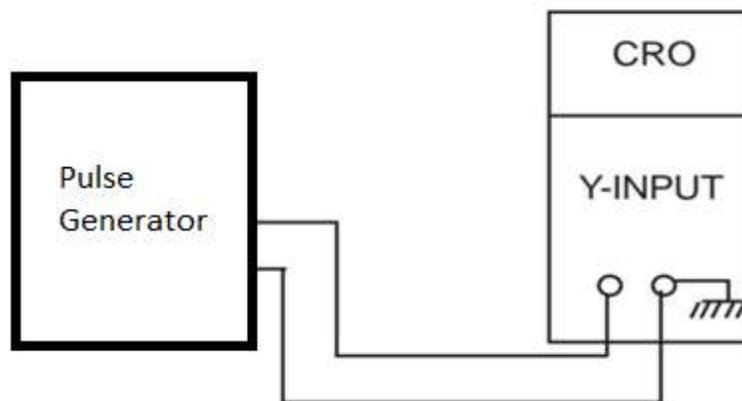
The cathode-ray oscilloscope (CRO) is a common laboratory instrument that provides accurate time and amplitude measurements of voltage signals over a wide range of frequencies. Its reliability, stability, and ease of operation make it suitable as a general purpose laboratory instrument.

➢ **Pulse Width and Duty cycle**

Pulse Width (PW) is the elapsed time between the rising and falling edges of a single pulse. To make this measurement repeatable and accurate, we use the 50% power level as the reference points.

Pulse Repetition Interval (PRI) is the time between sequential pulses. We typically measure PRI as the time from the beginning of one pulse and the beginning of the next. We use PRI to report the number of seconds per pulse.

Pulse Repetition Frequency (PRF) is the reciprocal of PRI. The basic unit of measure for PRF is hertz (Hz). Use PRF to report the number of pulses per second. Look at a 1 GHz clock signal as an example. The clock signal is a continuing stream of pulses at a PRF of 1 GHz.

Duty Cycle describes the "On Time" for a pulsed signal. We can report duty cycle in units of time, but usually as a percentage. Like Pulse Width and Repetition Frequency, a signal's duty cycle is a calculated value; not directly measured. To calculate a signal's duty cycle, we need to know the signal's pulse width and repetition frequency. Use this equation for calculating a signal's duty cycle as a percentage of the repetition frequency

$$\text{Duty Cycle (D) = Pulse Width (sec) }/T * 100$$

$$T=T_{ON}+T_{OFF}$$

➢ **Rise time and Fall time:**

Rise time refers to the time it takes for the leading edge of a pulse to rise from its minimum to its maximum value. Rise time is typically measured from 10% to 90% of the value. Conversely, fall time is the measurement of the time it takes for the pulse to move from the highest value to the lowest value. Fall time is the time taken for the trailing edge to fall from 90% to 10% of the value.
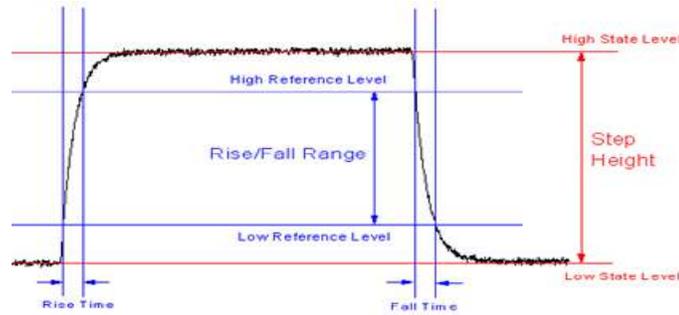
Procedure:

- Select the Pulse wave and set the frequency and amplitude to desired value in Pulse generator.
- Observe the Pulse wave on CRO by providing proper adjustments on CRO
- Measure the peak to peak voltage and time period
- Calculate pulse width.
- Calculate the Duty cycle.
- Draw the waveforms.

Observations:

➢ **Pulse Width, Duty cycle and frequency measurements**

S No	T_{ON}	T_{OFF}	T= T_{ON} + T_{OFF} (sec)	Rise time(t_r)	Fall time(t_f)	Duty Cycle= T_{ON} / (T_{ON} + T_{OFF})	Frequency(Hz)
1	4.5 us	3.5us	8us	0.25us	0.22us	0.563	125 KHz
2	3.5 us	3us	6.5us	0.19us	0.16us	0.538	154 KHz
3	5us	4us	9us	0.5us	0.45us	0.556	111 KHz
4	3us	2.5us	5.5us	0.22us	0.20us	0.545	182 KHz
5	10us	10us	20us	0.7us	0.66us	0.50	50 KHz

➢ **Amplitude measurement**

S No	No. of vertical divisions	Volts/Div	Pulse Amplitude = No. of vertical divisions X Volts/Div
1	2.8	50m	0.14 V
2	5.4	0.5	2.7 V
3	2.8	1	2.8 V
4	5.4	2	10.8 V
5	3.4	5	17 V

Measure Frequency of unknown signals using Lissajous figures on CRO

1. Description:

Name	Specification	Quantity	Purpose
CRO (Dual Channel)	0-20 M Hz	01	For displaying and measuring of waveforms
CRO probe		01	To make the connection to CRO from function generator/RPS
Function Generator (1Hz-1MHz).	1 Hz- 1 MHz	01	To generate AC signals
Connecting wires	Red, green, blue, and black. 3/20guage suitable lengths	As per the need	To make the connection and interconnections to equipment

**Circuit diagram:**

Theory:

➢ **CRO:**

The cathode-ray oscilloscope (CRO) is a common laboratory instrument that **provides accurate time and amplitude measurements of voltage signals over a wide range of frequencies**. Its reliability, stability, and ease of operation make it suitable as a general purpose laboratory instrument.

➤ **Function Generator:**

A function generator is a piece **of electronic test instrument used to generate and deliver standard waveforms, typically sine and square waves, to a device under test**. It can be used to test a design or confirm that a piece of electronic equipment is working as intended.

➤ **Lissajous Pattern:**

Lissajous figure is the pattern which is displayed on the screen, when sinusoidal signals are applied to both horizontal & vertical deflection plates of CRO. These patterns will vary based on the amplitudes, frequencies and phase differences of the sinusoidal signals, which are applied to both horizontal & vertical deflection plates of CRO.
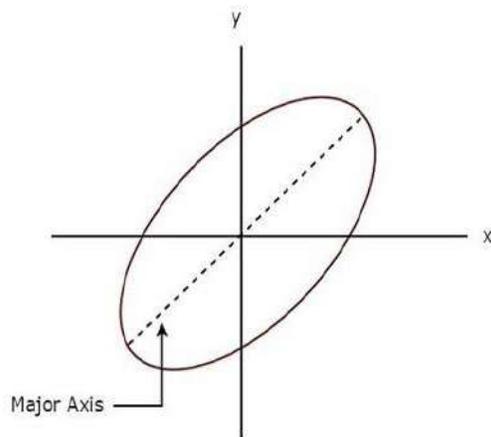
The following figure shows an **example** of Lissajous figure.
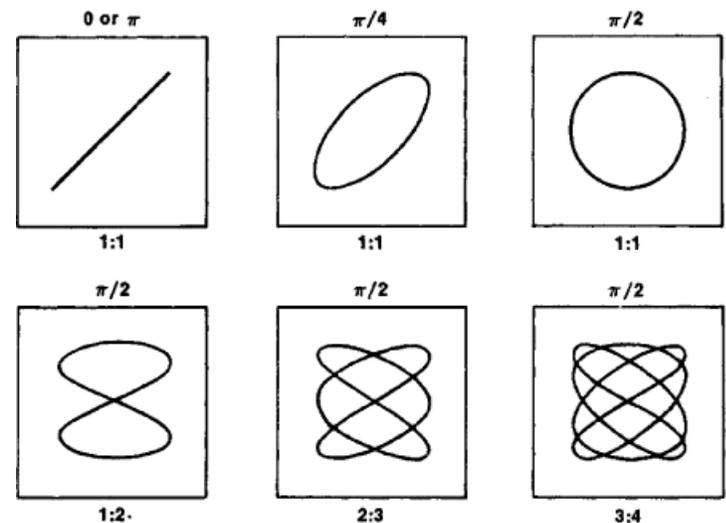
The above Lissajous figure is in **elliptical shape** and its major axis has some inclination angle with positive x-axis. We can do the following **two measurements** from a Lissajous figure.

- Frequency of the sinusoidal signal
- Phase difference between two sinusoidal signals

Procedure:

- A known frequency is applied to horizontal plates and unknown frequency to the vertical plates.
- The various controls are adjusted
- A pattern with loops is obtained. Such patterns are called Lissajous figures or Lissajous patterns.
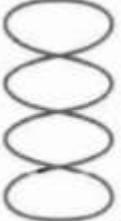
- The number of loops touching to the horizontal line gives the frequency on the vertical plates (fv) and the number of loops touching to the vertical line gives the frequency on the horizontal plates (fh).

$$\frac{fh}{fv} = \frac{\text{Number of loops touching to the vertical line}}{\text{Number of loops touching to the horizontal line}}$$

or

$$\frac{fy}{fx} = \frac{\text{Number of horizontal tangents}}{\text{Number of vertical tangents}}$$

Observations:

S No	Known Freq.	Lissajous Pattern	No of horizontal tangencies (f$_h$)	No of vertical tangencies (f$_v$)	$Unknown\ freq = \frac{\text{No of horizontal tangents}}{\text{No of vertical tangents}} \times Known$ freq.
1	10 KHz		3	1	30 KHz
2	10 KHz		1	4	2.5 KHz

PA system

1. Description:

Name	Specification	Quantity	Purpose
Microphones	Cord and cordless	02 Nos	To get the source signal
Loud Speakers	4,8,16,32 Ohm	02 Nos	To provide audio output
Amplifier Kit	100W	01 No	To amplify the source signal to the desired level
Multimeter	digital	01 No	To test the equipment
A.C Mains cable with plug	230V,50Hz	As per the need	To make the connection and interconnections to equipment
Battery terminal block	12v-7.2Ah	01 No	For connecting D.C battery as standby power source

2.Circuit diagram:
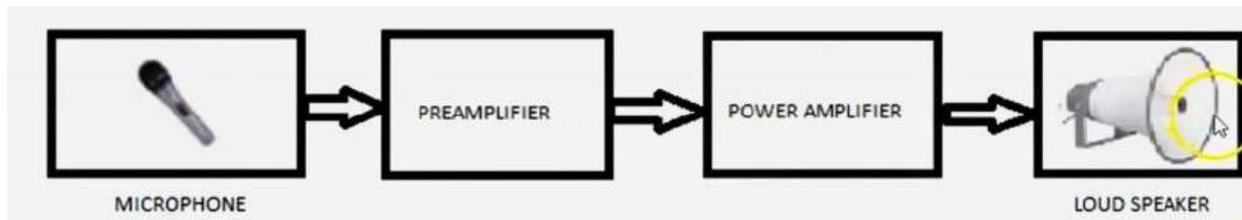
3.Theory:

A public address system amplifies low level sound to a higher level so that it can be heard by large number of people gathered and at a considerable distance. A basic public address system has input source is a microphone, which pickups low level sound like a human speech. Examples of some other input sources are a cassette player for playback of recorded music, or compact disc player.

AMPLIFIER:

It is an electronic circuit which converts low level signal to higher level signal and improves the signal gain. The gain depends upon the number amplifiers are used in cascaded stages. This determines the AF power levels. This amplifier consists of 3 or 4 microphone auxiliary circuits at input level with controlling switches for each microphone. Each microphone has got volume controllers to control audio

signal levels. Special electronic circuit provides and excellent sound quality, cut and boost type Bass and Treble controls, master control, 4 input volume controls and a special feature of adjusting tape sensitivity through tape Hi/Lo switch have been provided. An LED ARRAY gives a visual indication of the output level. Line output in addition to speaker outputs of 4,8,16 ohm and 100W is provided.

4. Procedure:

1. Microphone Connection:

4 independent microphone inputs have been provided through jacks on the front panel. Mic 4 input may be used by keeping the Mic / Tape - Lo Tape, Hi selector switch at MIC position. Microphone inputs are unbalanced Low impedance usable with microphones of impedance 200 - 600. In case microphones with both HIGH and LOW impedance are used, be sure that switch on the microphone is at low position. Microphone with up to 30 meter long cable can be used always use good quality shielded cables. For good intelligibility of sound, the microphone should be placed at least 20 cm's away from the speaker's mouth. Keeping the microphone too close to the mouth will result in distortion of sound and may even cause damage to the diaphragm of the microphone.

2. SPEAKER CONNECTIONS:

Speaker impedance taps of 4, 8 and 16 have been provided for direct connection of speakers to the amplifier when the distance between the amplifier and speakers is less than 50 meters. Use 23/26 or thicker cable for connections. Be sure that the total impedance of the speakers is equal to the impedance specified on the terminal strip.

3. PHASING OF LOUDSPEAKERS / UNITS:

When two or more speakers / units are installed in the same area and are facing in the same direction, it is essential that their cones / diaphragms move in unison. Otherwise, the sound output of one speaker will cancel the sound output of other. To avoid any mistake, the terminals of all driver units are marked L1 & L2. For correct wiring refer the sketches. Even if any one of the equipment or item is of poor quality, the sound quality will be bad.

FEATURES OF SMART TELEVISION

1. *Description*

The setup for this experiment requires the following equipment

Name	Specifications/ Range	No	Purpose
Smart TV	Any OS based smart TV	1No	To explore different features of smart TV
cables	As per the requirement		For interconnection

2. *Theory:*

Theory: A Smart TV device is digital television set with integrated Internet capabilities or a set-top box for television that offers more advanced computing ability and connectivity than a contemporary basic television set.

A smart TV has interactive features, which allows users to stream music and videos, browse the internet, play video games and view photos. Smart TVs are a technological convergence of computers, televisions, and digital media players. Besides the traditional functions of television sets provided through traditional broadcasting media, these devices can provide access to over the-top media services such as streaming television and internet radio, along with home networking access.

The Rear view of a typical smart TV is given in the figure-1
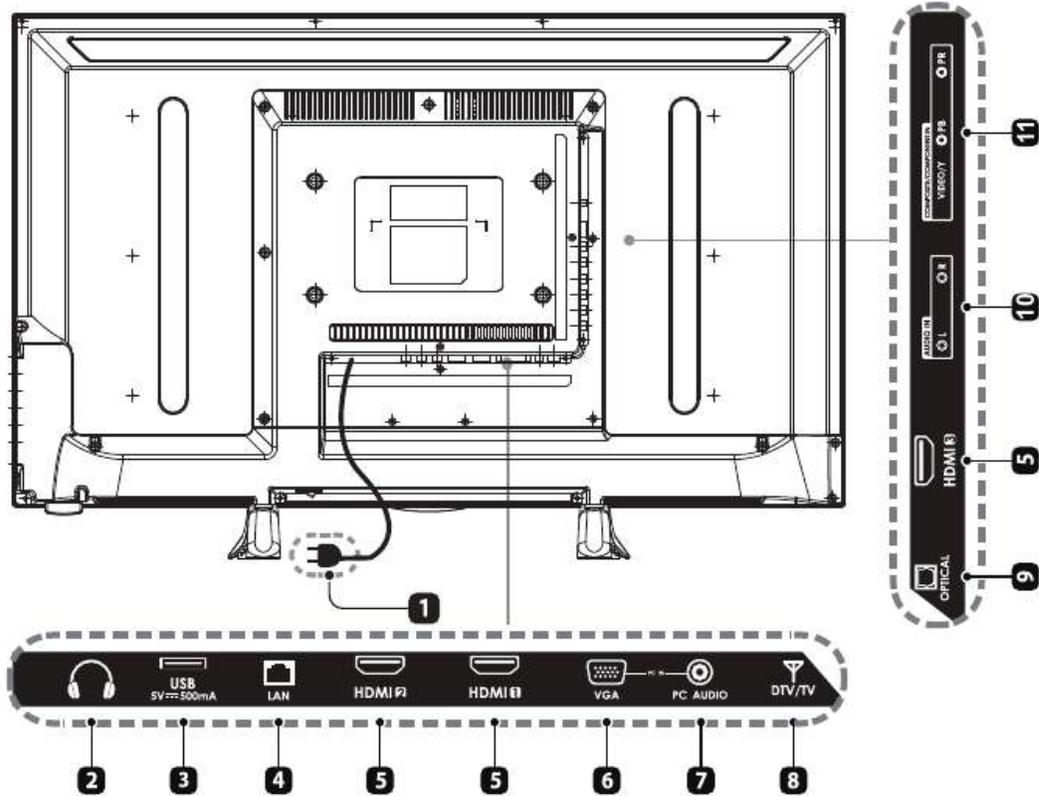
1. **Power Cord**
   Connect to AC power outlet.
2. **Headphone Socket**
   Connect to the Headphones.
3. **USB Port**
   Connect to a USB storage device to play compatible audio and photo files.
4. **LAN**
   Network connection port.
5. **HDMI Input**
   Connect to a High-Definition (HD) signal input device.
6. **VGA Input**
   Connect to a computer or other devices with a VGA interface.
7. **PC AUDIO Input**
   Connect to a computer audio output.

8. **DTV/TV Input**
   Connect to the antenna (75Ω VHF/UHF) socket with the RF coaxial cable.
9. **OPTICAL Output**
   Connect a digital sound system to this jack.
10. **AUDIO Input**
    Connect to the AUDIO (L/R) output sockets on external audio devices.
11. **COMPOSITE/COMPONENT IN**
    Connect to AV devices with composite/ component (Y/Pb/Pr) video and audio output sockets. COMPOSITE VIDEO and COMPONENT(Y/PB/PR) share with AUDIO IN (L/R).

The different cables and connectors used in Smart TV is presented in figure 2
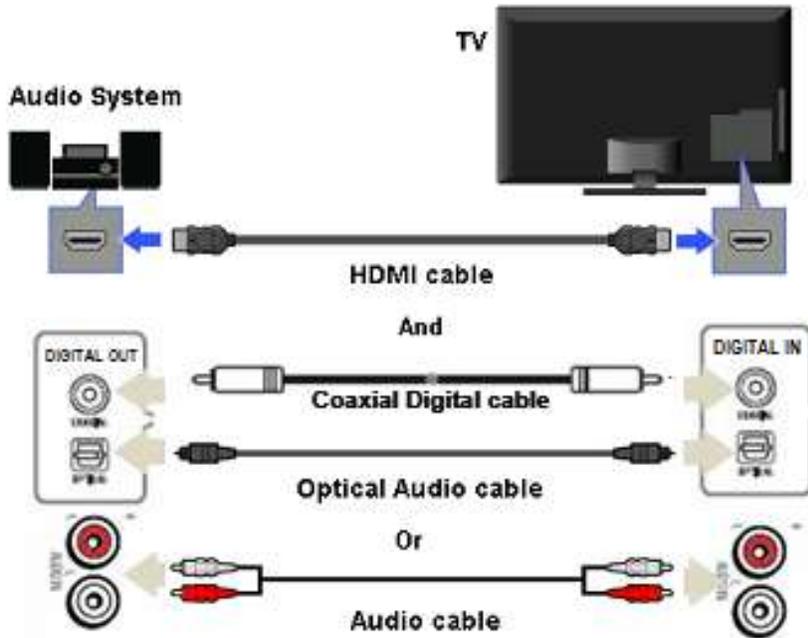
The front view of a typical smart TV remote control is given in figure 3
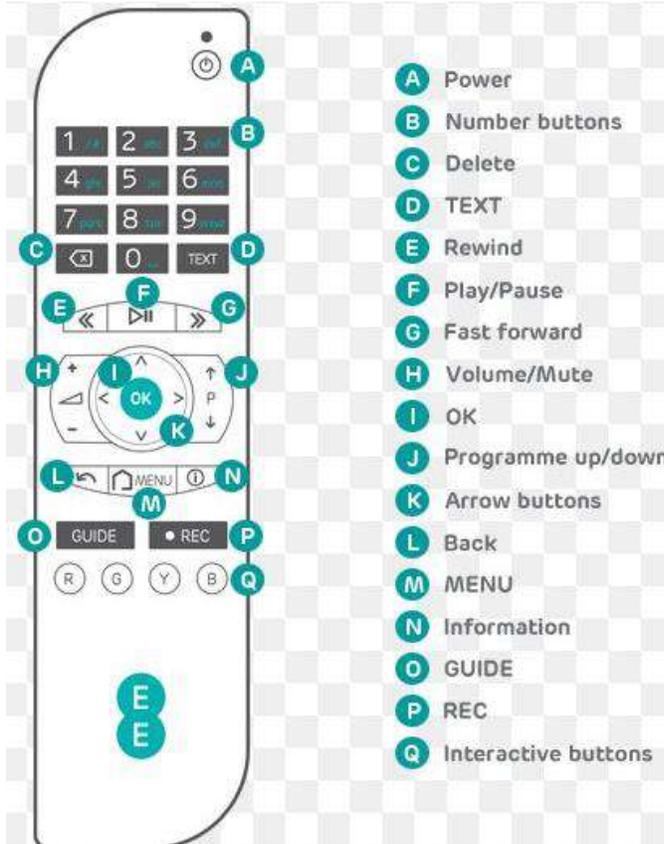
Features:

Browsing the web

Most of the smart TVs have built-in OS and have LAN port (RJ45), wifi and Bluetooth connectivity. With the help of these connectivity, a smart TV can be connected to the Internet and access any site on the Internet as we can visit normally on a computer. This feature makes it easy to view social networks online and watch streaming videos.

Online streaming

You don't have to download everything you want to watch or play – you can watch various things streaming – including YouTube and Netflix..

Screen mirroring

It enables to transmit the screen of mobile device on to the TV screen. I allows to view streaming media, photos, or favorite music or apps on the large screen of TV.

Applications and Games

Netflix and YouTube feature their own apps for Smart TVs as well as many other popular brands (Angry Bird being one of them). Most apps are geared towards video and streaming data, though games are increasingly becoming more popular. Some Smart TV platforms have developed their own applications for their TVs

Social networking

Most Smart TVs are capable of Skype video conferencing. You can also log into your social networks via internet browser.

Voice control

Some of the newer versions of Smart TV have the ability to navigate the TV using voice control via the remote control. you can simply press a "mic" button on your remote control and tell it what you want ("open Netflix" or "volume up" etc.).

Motion Control

Some of the newest Smart TVs come with built-in motion control features, making it easier for you to select movies or play games while using just a sweep of your hand.

3. Procedure:

    a.   **Browsing the web**

        i.   Switch ON Smart TV.
        ii.   On the remote control, press the HOME or MENU button.
        iii.   Select Apps or Applications. If the Internet Browser icon isn't displayed, go to All Apps or All Applications. ...
        iv.   Select Internet Browser.
        v.   Press the button.
        vi.   To exit the browser, press MENU or HOME button.

    b. **Online streaming**

    i.   Connect smart TV to the internet.
    ii.   Download, sign up, and sign in to streaming apps.
    iii. Use the app to select and play the required on-line video for streaming
       .

    c.   **Screen mirroring**

    i.   It enables to transmit the screen of mobile/laptop/PC device on to the TV screen.
    ii.   On your PC/Laptop, click Start, then Settings, and then Devices.

iii. Click Bluetooth & other devices, then Add Bluetooth or other device, and then Wireless display or dock.
iv. Click the smart TV once its name is displayed. ...
v. When the connection is complete, click Done on your PC.
vi. Screen mirroring from the smart phone requires an app (miracast or equivalent) to be installed on to the mobile phone. Use the app to mirror the screen on to the TV

d. Connecting Bluetooth speakers
i. Activate Bluetooth speakers pairing mode as per the steps mentioned by manual of Bluetooth speakers.
ii. From the home menu of the smart TV, locate the settings icon, and under the menu, click on remote and accessories
iii. From the display resulting list, click on add accessories. TV shall automatically search the available Bluetooth devices. Select the required Bluetooth speakers and pair them.

e. Voice control
i. Activate voice control on TV using the following instructions
ii. Press the HOME button.
iii. Select Settings → Network & Accessories → **Touchpad Remote Control** or Voice Remote Control.
iv. Select Pair Touchpad Remote Control or Activate the MIC button.
v. Follow the on-screen instructions.

5. *Precautions:*

(a) *Procedural precautions:*

- Ensure that all the equipment is disconnected from mains before making connections.
- Handle the equipment with care
- Ensure that there are no loose connections.
- Get the connections checked by the concerned staff member.
- Protect your router credentials
- Sort your networks and devices
- Configure your Smart TV
- Install the latest updates
- Use a complete security solution
- Download applications with caution
- Use streaming with caution

(b) *Safety Precautions:*

- Do not connect power to the equipment until required connections are finished and after carefully checking the connections as per the manual.
- If you smell anything burning, immediately disconnect the power and examine your circuit to find out what went wrong.
- Keep your work area dry.

Assessment questions/Viva

1. How do you mirror cast to smart TV?
2. What is the use of voice control?
3. How do you setup voice control on your smart TV?
4. For what purpose HDMI port is used?
5. What are the different rear panel ports available on a typical smart TV
6. What are the different ways of connecting smart TV to internet

Record & reproduce voice digitally

1. Description

To study record and reproduce voice digitally

Name	Quantity	Purpose
C8051F411 microcontroller	1	Comprises of ADC and DAC
Speaker	1	Converts electrical signal to sound signal
Microphone	1	Converts sound signal to electrical signal
Pushbuttons and LED	1	To Switch-ON IC
Flash memory	1	Storage

BLOCK DIAGRAM
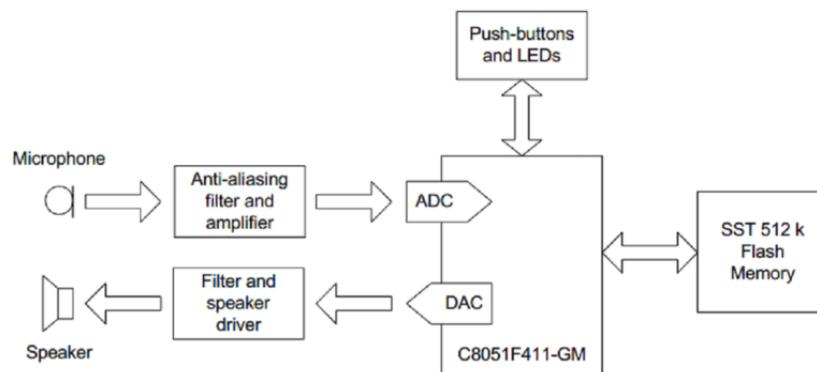
Theory:

Voice recorders are required in many modern applications which require recording sound such as speech, singing and instrumental music. In a digital voice recorder, the sound is stored as a series of numbers wherein each number represents the air pressure at a particular time. These numbers are then generated by a microphone, which is connected to a circuit called an analog-to-digital converter. Eventually, these numbers will be converted back into sound by a digital-to-analog converter that is connected to a speaker. The amount of bits in the number is directly related to the fidelity of the signal. This simply means that a higher quality of sound recorded consumes more memory.

This design relies on a C8051F411 microcontroller to sample (via the ADC), compress, store and playback voice signal. 12-bit ADC and DAC allow high quality sound at 8 kHz sampling rate. A microphone, speaker, pushbutton and LEDs are provided for user interaction. The recorder uses DPCM (differential pulse code modulation) compression algorithm for data storage to extend the total recording time.

Several file formats may be used for storing audio recordings However, in most cases, a WAV file is the best format to store the recording. Common file formats of digital voice recorders include the following:

- **AAC (Advanced Audio Coding):** This is the standard compression method used by iTunes, YouTube, iOS, and Android, to name a few.
- **AIFF (Audio Interchange File Format):** This format was developed by Apple.
- **AU:** This audio file format was developed by Sun Microsystems.
- WAV (**waveform** audio file)**:** This is a standard for IBM and Microsoft.
- **MP3:** For most voice-only application, this is the most common format

Procedure

1. Connect as per the block diagram.
2. Switch on the trainer kit.
3. Apply voice signal to the MIC.
4. Check the voice signal at the speaker.

Observations

1. To Connect the microphone, C8051F411 microcontroller, flash memory and speakers to form Voice recorder and playback player.
2. Adjust the amplifier to get proper volume.

Precautions:

1. Connections should be tight.

2. Handling the Equipment Carefully.

3. Before start recording, make sure that memory is not full.

ARRANGE LCD PROJECTOR

Objective: To setup LCD Projector

1. Description

The setup this experiment requires the following equipment

Name	Quantity	Purpose
PC/ Laptop	1	To Connect projector
LCD Projector	1	To project video, slides, and images onto a screen.
LCD Screen	1	
Connectors		To make interconnection between Computer to Projector
Power chords		To connect power supply

3.Theory

Various operating controls of LCD Projector is shown in Figure-1. The function of each button with respect to Figure-1 is described as follows

Operating Controls of LCD Projector:

1. Power Button (ON / STAND BY : Use this button to turn the power on and off when the power is supplied and the projector is in standby mode.

2. Status Indicator : When this is lit red continually, it's warning you that the projection lamp has exceeded 1000 hours (up to 2000 hours in Eco 2 mode and 1500 hours in Eco 1 mode) of service. After this light appears, it is advisable to replace the projection lamp as soon as possible .
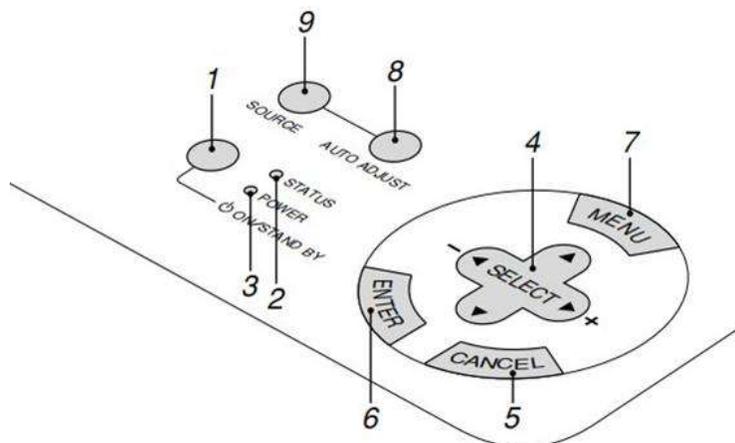
Figure-1: Operating controls of LCD Projector

3. Power Indicator : When this indicator is green, the projector is on; when the indicator is orange, it is instandby mode.

4. Cancel Button: Press this button to exit the menu. While you are in the adjustment or setting menu,pressing this button will return to the previous menu.

5. Enter Button: Executes your menu selection and activates items selected from the menu.

6. Menu Button: Displays the menu.

7. Auto Adjust Button: Use this button to adjust Position-H/V and Pixel Clock/Phase for an optimal picture.

8. Source Button Use this button to select a video source such as a PC, VCR or DVD player. Each time this button is pressed, the input source will change as follows: → RGB → Video → S-Video → RGB ... If no input signal is present, the input will be skipped.

Ports of LCD Projector:

The ports available on the rear panel of LCD projector is shown in Figure-2. The function of each port is as follows:

1. **RGB Input Connector (Mini D-Sub 15 pin) :** Connect your PC or other RGB equipment.Use the supplied signal cable to connect to a PC.
2. **RGB Monitor Output Connector (Mini D-Sub 15 pin) :** Use this connector to loop your computer image to an external monitor from the RGB input source.
3. **Audio Input (Mini Jack) :** To connect audio output from your computer.
4. **Audio Input (RCA)** To connect audio output from a VCR, DVD player, or laser displayer.
5. **Audio Output (Mini Jack) :** To Connect audio equipment to this jack.
6. **Video Input (RCA)** Connect a VCR, DVD player, laser disc player, or document camera here toproject video.
7. **S-Video Input Port (Mini DIN 4 Pin)** Connect the S-Video input from an external source like aVCR.
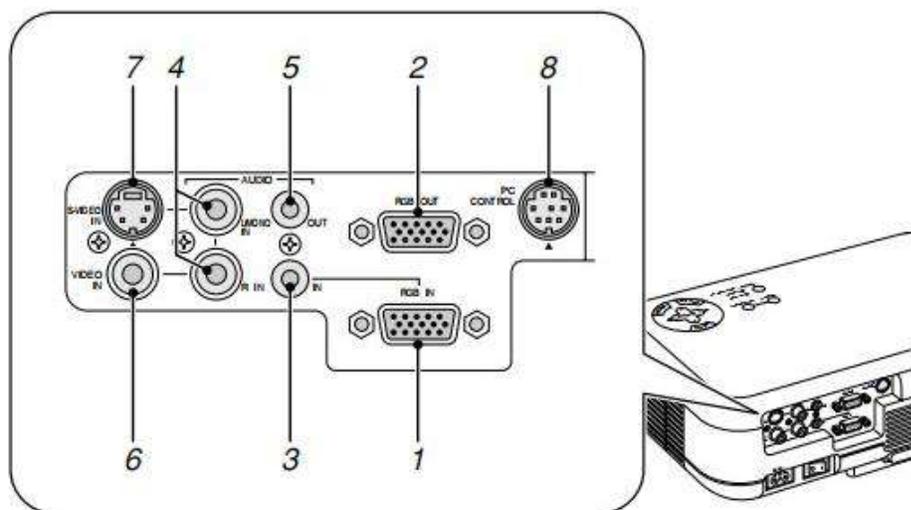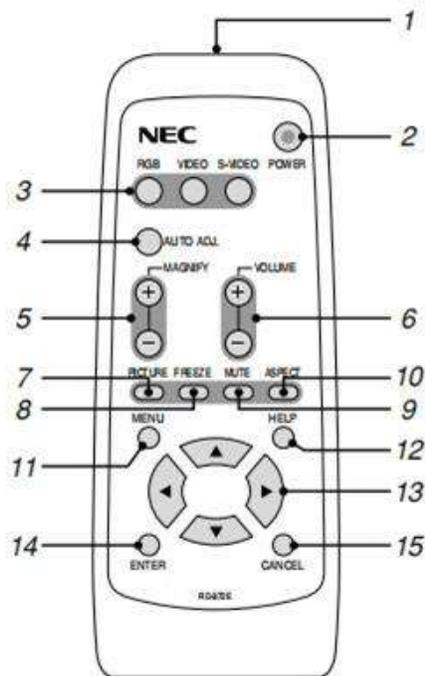8. **PC Control Port (Mini DIN 8 Pin)** Use this port to connect your PC to control your projector.

Figure-2: Ports of LCD Projector

Remote Control:

The schematic of remote control is shown in figure 4. The function of each button is described as follows:

Remote Control Features

1. **Infrared Transmitter** Direct the remote control toward the remote sensor on the projector cabinet.
2. **Power Button** If power is applied, you can use this button to turn your projector on and off.

3. **Source Buttons** Press to select a video source.
4. **Auto Adjust Button** Use this button to adjust Position-H/V and Pixel Clock/Phase for an optimal picture.
5. **Magnify Buttons** Use the (+) or (−) button to adjust the image size up to 400%.
6. **Volume Buttons** Press (+) to increase the volume and (−) to decrease it.
7. **Picture Button** Press this button to display the Picture adjustment window. Each time this button ispressed, the current picture adjustment item will change as follows:

Brightness → Contrast → Color → Hue → Sharpness

8. **Freeze Button** This button will freeze a picture. Press again to resume motion.
9. **Mute Button** This button turns off the image and sound for a short period of time. Press again torestore the image and sound.
10. **Aspect Button** Press this button to display the Aspect Ratio select window. Each time this button ispressed, the current aspect ratio will change as follows:

Normal → Zoom → Wide Zoom → Cinema → Normal →

11. **Menu Button** Displays the menu.
12. **Help Button** Provides information about the current signal and the status of the projector

2. Procedure for setting up projector

Setting up Your Projector
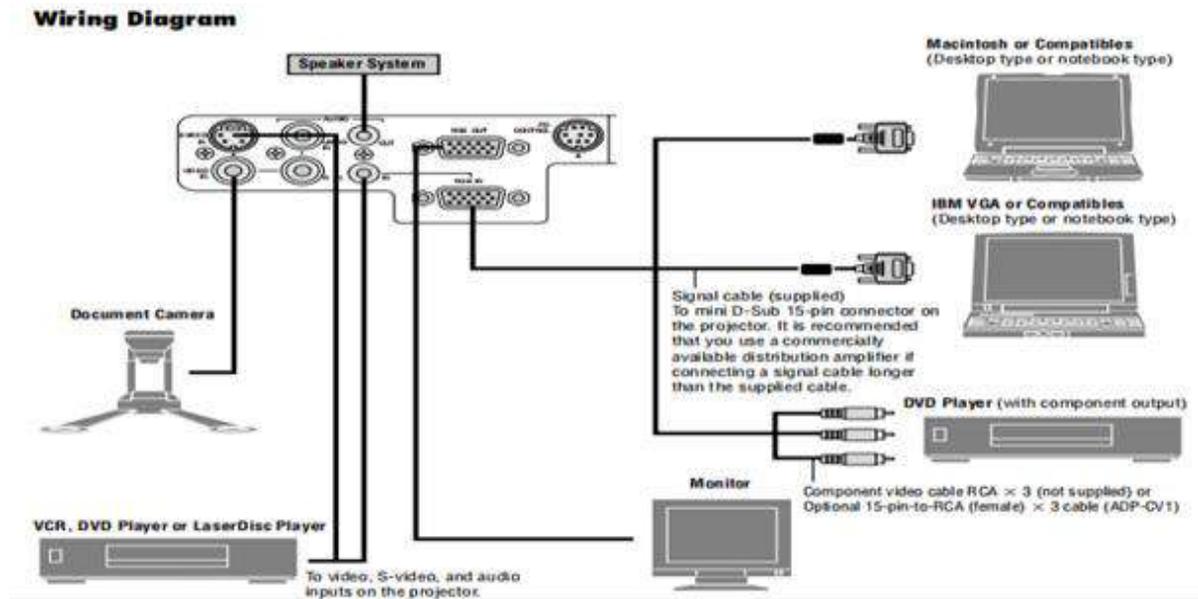1. Connect LCD Projector as shown in figure-1.

Figure-1: Wiring diagram of LCD Projector

2. Make sure that PC to be connected to the LCD Projector is **turned off**.

3. Connect the video cable (**usually VGA**) from the PC's external video port to the corresponding video port of the projector.

4. Plug your projector into an electrical outlet and press the **"power"** button to turn it ON.

5. Turn on the PC.

6. If you need audio for your presentation, connect the PC's **"audio out"** port to the projector, or to another sound system.

7. Adjust the image size, sharpness, contrast, focus and shape etc by adjusting various functional keys available on the projector.

Precautions:

- Do not move the projector during use. Before moving, disconnect the power cord and all external connections, and close the slide lens door or attach the lens cap.
  - Avoid any impact or shock to the projector.
  - Do not drag the projector.
  - For moving the projector, use the enclosed case or bag if provided.
- Do not put anything on top of the projector

- **Take care of the air filter to normal ventilate:**

    - The air filter should be cleaned periodically. If the air filter becomes clogged by dust or the like, internal temperature rises and could cause malfunction. The projector may display the message such as "CHECK THE AIR FLOW" or turn off the projector, to prevent the internal heat level rising.

    - When the indicators or a message prompts you to clean the air filter, clean the air filter as soon as possible.

    - If the soiling does not come off the air filter, or it becomes damaged, replace the air filter.

    - Use the air filter of the specified type only. Order the air filter specified in the other manual of this projector to your dealer.

    - Do not turn on the projector without air filter.

- **Avoid Magnetism:** Manufacture strongly recommends avoiding any magnetic contact that is not shielded or protected on or near the projector itself.

- **Take care of the lens:** Close the slide lens door or attach the lens cap to prevent the lens surface being scratched when the projector is not used. Do not touch the lens to prevent fog or dirt of the lens that cause deterioration of display quality.

- **Turn the power on/off in the right order:** Power on the projector before the computer is turned On. Power off the projector after the computer is turned off.
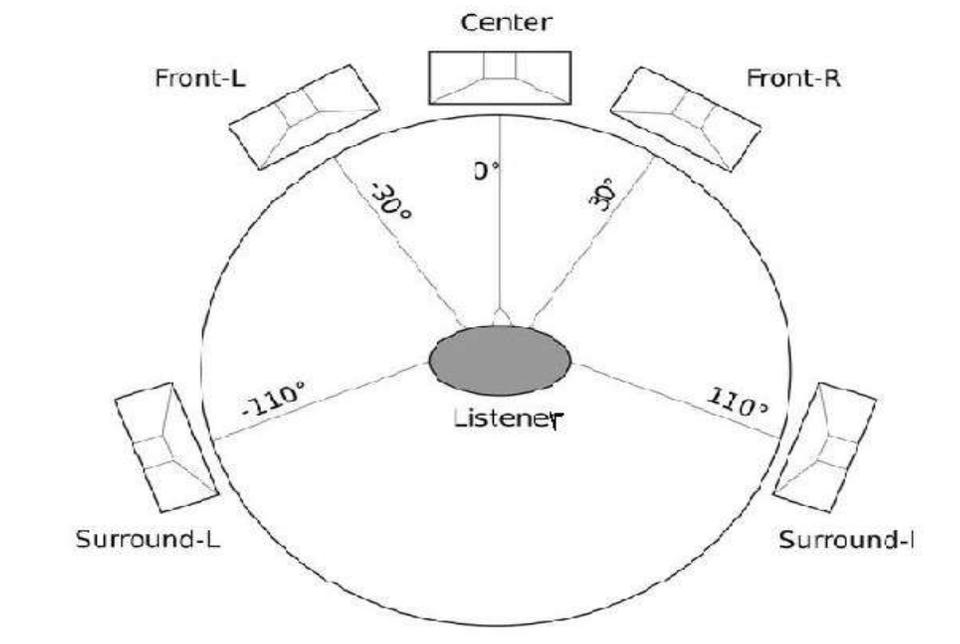
5.1 CHANNEL AUDIO SYSTEMS

1. Description

To set up and test 5.1 channel audio systems

Name	Quantity	Purpose
Left & right speakers	2	Happening on the screen
Center speaker	1	Happening on the screen
Subwoofer	1	Impact to action scenes
cables	Required No.	To connect speakers and woofers
Left & right surround speaker	1	Spatial awareness

BLOCK DIAGRAM

Theory:

Surround sound uses multiple audio channels and an array of speakers to reproduce audio. This affords a more realistic emulation of sound than the typical 2.1 stereo setup. The more numbers (audio channels) added to a given configuration, the more realistic will be the sound. There are three popular configurations: 5.1, 7.1, and 9.1. These numbers address the number of channels, where the first number marks the standard speaker units and the second

number specifies how many low-frequency channels exist. It's treated with a low-pass filter and attenuates frequencies higher than 120Hz.

The most popular home theater setup is a 5.1 configuration, which consists of six channels. Five of them are standard speakers while one is a dedicated subwoofer for low-frequency reproduction. This arrangement gives a comprehensive surround sound experience without overcomplicating setup. There are three front channels, two rear (surround) channels, and one subwoofer channel. It's the standard for DVD and Blu-ray media: Dolby Digital and Dolby DTS also operate on the 5.1 format. Some systems require an audio-visual (AV) , where AV receiver simultaneously receives audio and visual signals from multiple sources. It then processes and amplifies those signals to drive the speakers and display (e.g.TV, monitor, projector).

Decoders

AV receivers typically have more than one decoder. A good starting point is to look for a Dolby Digital-ready receiver: every DVD and all United States HD broadcasts use Dolby Digital. These certified receivers include inputs and amps for additional channels and ensure the inclusion of a Dolby Digital decoder. If you're arranging a 7.1 setup, lookout for a receiver which supports Dolby Digital Plus.

Select cables for specific inputs and outputs

AV receivers have a more number of connectors.

HDMI:

HDMI is used for all HD and 4K sources (e.g. Blu-ray players, cable boxes, and gaming consoles). Receivers typically have two to four HDMI inputs and an output which goes to your TV.

Digital coaxial and optical :

Coaxial and optical inputs serve the same purpose. These connections transmit Sony/Phillips digital audio interface (S/PDIF) signals between various devices. They support stereo, Dolby Digital surround sound and DTS.

Multi-channel analog connections :

Rather than assigning a basic left and right connection, as stereo setups do, surround sound requires dedicated inputs per channel: left front/back, right front/back, and center. This is used for connecting a DVD or Blue-ray player to your AV receiver.

Speaker terminal:

Speaker connections are key to setting up a home theater system. Each section is labeled: front, center, surround, etc.

Any speaker that doesn't serve as its own power source gets connected here via speaker wire and banana plugs.

Procedure

1. For a 5.1 system, there are three front-channel speakers, two rear-channel speakers, and one subwoofer. So we have to place the speakers depending on its dedicated channel.

2. The center channel goes directly in front of your couch and the driver should be parallel to your couch and as high off the ground as your ears when sitting.

3. After that, take your side-channel speakers and place them a bit behind the TV, equidistant from you and the screen and rotate them toward the center until each hits a 22-30º angle.

4. Then there are the rear left and right speakers. They have a sharper 90-110º angle. Both speakers should be equidistant from you and sit just above your ear.

5. Finally, there's the subwoofer. This takes care of all the explosions and adds impact to action scenes. It can be placed on either side of your TV, between the front left and right speakers, close to the center.

Observations

To Connect the speakers and woofer to make 5.1 Channel Audio System.

Precautions:

1. Connections should be tight.

2. Handling the Equipment Carefully.

3. Left and Right speakers should be equidistant from you and sit just above your ear.

TIME: 3 hours   Total Marks: 60

Instructions: (1) Any one full question of the following shall be allotted to the students on lottery basis.

(2) All the questions are competency based and are for assessing the candidate's psychomotor skills

(3) Answers for the Questions should be brief and straight to the point.

(4) Underpinning knowledge shall be assessed through **viva-voce** for *six* marks
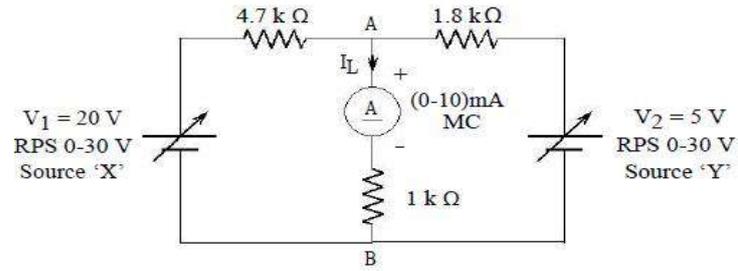
1. a) Make the Circuit to verify series resonance using given components   (9M) (CO2)
    b) Measure the frequency of a given sinusoidal signal using frequency counter and compare the frequency counter value with the displayed in function generator   (15M) (CO1)
    c) Measure the resistance, inductance and capacitance of given resistors, inductors and capacitors respectively using LCR meter   and compare with their colour coded /marked values.   (30M)(CO1)

2.   a) Make connections to verify parallel resonance using the given components and identify the values of the given components   (9M) (CO2)

    b) Draw the front panel diagram of LCR meter and identify the function of different controls
                                                                                                        (15M) (CO1)

    c) Test the given ICs using digital IC tester and specify their working condition   (30M)(CO1)
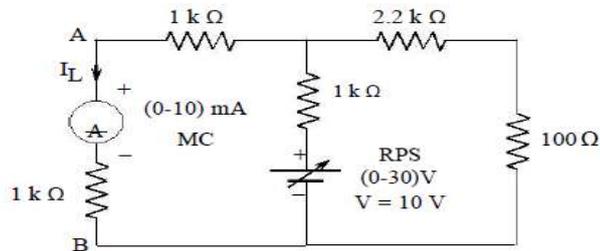
3.   a) Draw the front panel diagram of LCR meter and identify various controls in it   (9M) (CO1)
    b) Make the connections to verify maximum power transfer theorem with Source voltage of 20Volts, Source resistance of 1K Ω and load resistance 1200Ω (using DRB)   (15M) (CO2)
    c) Make a circuit to verify series resonance and conduct an experiment to determine the bandwidth, resonance frequency by plotting its frequency response curve   (30M)(CO2)

4.   a) Make the series resonance circuit with given components   (9M) (CO2)
    b) Measure the frequency of a given sinusoidal signal using frequency counter and compare the frequency counter value with the displayed in function generator   (15M) (CO1)
    c) Make the circuit to verify maximum power transfer theorem and conduct an experiment to plot a graph between load resistance Vs power delivered to load. From the graph identify the load resistance at which maximum power is delivered   (30M)(CO2)

5. a) Draw the front panel diagram of LCR meter and identify various controls in it   (9M) (CO1)
    b) Make the following circuit and set voltage values as shown in the circuit.   (15M) (CO2)

c) Make a circuit to verify parallel resonance and conduct an experiment to determine the resonance frequency by plotting its frequency response curve   (30M)(CO2)

6. a) Draw the front panel diagram of LCR meter and identify various controls in it   (9M) (CO1)

b) Make the following circuit with the specified component values and measure Thevenin'svoltage across A, B terminals   (15M)(CO2)

c) Make the following circuit. Conduct an experiment to verify superposition theorem by measuring current through the R_2 resistor. Compare this measured value with the theoretical value.   (30M)(CO2)

7. a) Draw the front panel diagram of LCR meter and identify various controls in it   (9M) (CO1)

b) Make the following circuit with the specified component values. Calculate resonance frequency.   (15M) (CO2)
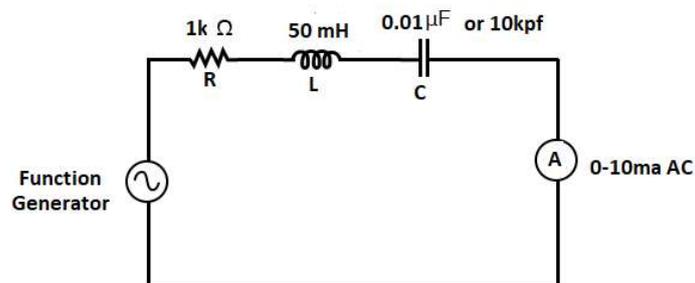
c) Make the following circuit. Measure current through the load resistor by applying Thevenin's theorem. Compare measured load current with the theoretical value.   (30M)(CO2)

Model Question Paper (C-20)
C-20, EC-310, Measurements & Network Analysis Lab

TIME: 3 hours   Total Marks: 60

Instructions: (1) Any one full question of the following shall be allotted to the students on lottery basis.
(2) All the questions are competency based and are for assessing the candidate's psychomotor skills
(3) Answers for the Questions should be brief and straight to the point.
(4) Underpinning knowledge shall be assessed through **viva-voce** for *six* marks

1. (a)   i)Identify the front panel controls of CRO.
      ii) Identify the front panel controls of function generator.   (9M) (C03)
   b)   Make the connection for testing PA system.   (15M)(C04)

   (c) Calculate Unknown frequency by generating different Lissajous patterns for given 5 KHz input signal.   (30M)(CO1)

2.   a) i) Identify the front panel controls of CRO.
       ii)Identify the front panel controls of Pulse generator.   (9M) (C03)

     b) Make the connection for measuring unknown frequency by using Lissajous pattern on CRO
                                                                (15M) (CO1)

     c) Demonstrate the following features of smart TV :i) Screen Mirroring ii) Web Browsing
                                                                (30M)(CO1)

3.   (a) i) Identify the front panel and rear panel controls of PA System
         ii) Identifying various cables and connectors used in PA system.   (9M) (C04)

      (b) i) Make the connection for measurement of DC Voltage using CRO.
         ii) Make the connection for measurement of AC Voltage using CRO   (15M) (C03)
         (30M)(CO4)
      (c) Arrange the given LCD projector and demonstrate various operating controls in it (30M)(CO4)

4   (a) i)Identify the front panel controls of CRO.
       ii)Identify the front panel controls of Function generator.   (9M) (C03)

     b)Demonstrate recording and reproduction of voice using mobile phone/ or any voice recorder
                                                                (15M) (CO1)
     (c) Test the PA system by adjusting different controls knobs on Amplifier.   (30M)(C04)

5. a) Identify different rear panel ports and their function in a given smart TV   (9M) (CO1)
    b) Make the connection for measurement of pulse parameter using CRO.   (15M) (C03)
    c) Setup and test a given 5.1 channel or 7.1 channel audio system   (30M) (CO4)
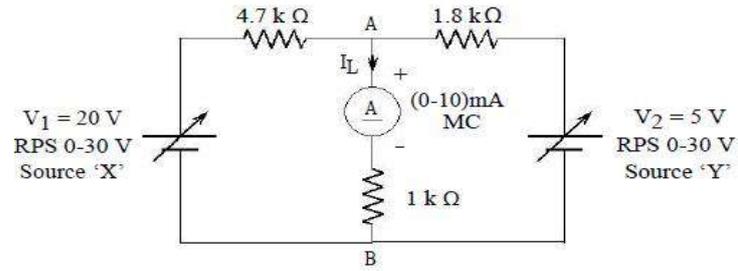.

TIME: 3 hours   Total Marks: 60

Instructions: (1) Any one full question of the following shall be allotted to the students on lottery basis.

(2) All the questions are competency based and are for assessing the candidate's psychomotor skills

(3) Answers for the Questions should be brief and straight to the point.

(4) Underpinning knowledge shall be assessed through **viva-voce** for *six* marks

1. a) Make the Circuit to verify series resonance using given components   (9M) (CO2)

   b) Measure the frequency of a given sinusoidal signal using frequency counter and compare the frequency counter value with the displayed in function generator   (15M) (CO1)

   c) Setup and test a given 5.1 channel or 7.1 channel audio system   (30M) (CO4)

2. a) Make connections to verify parallel resonance using the given components and identify the values of the given components   (9M) (CO2)

   b) Draw the front panel diagram of LCR meter and identify the function of different controls
   (15M) (CO1)

   c) Demonstrate the following features of smart TV :i) Screen Mirroring ii) Web Browsing
   (30M)(CO4)

3. a) Draw the front panel diagram of LCR meter and identify various controls in it   (9M) (CO1)

   b) Make the connections to verify maximum power transfer theorem with Source voltage of 20Volts, Source resistance of 1K Ω and load resistance 1200Ω (using DRB)   (15M) (CO2)

   c) Make a circuit to verify series resonance and conduct an experiment to determine the bandwidth, resonance frequency by plotting its frequency response curve   (30M)(CO2)

4. a) Make the series resonance circuit with given components   (9M) (CO2)

   b) Measure the frequency of a given sinusoidal signal using frequency counter and compare the frequency counter value with the displayed in function generator   (15M) (CO1)

   c) Make the circuit to verify maximum power transfer theorem and conduct an experiment to plot a graph between load resistance Vs power delivered to load. From the graph identify the load resistance at which maximum power is delivered   (30M)(CO2)

5. a) Draw the front panel diagram of LCR meter and identify various controls in it   (9M) (CO1)

   b) Make the following circuit and set voltage values as shown in the circuit.   (15M) (CO2)

c) Make a circuit to verify parallel resonance and conduct an experiment to determine the resonance frequency by plotting its frequency response curve   (30M)(CO2)

6. . a) Identify different rear panel ports and their function in a given smart TV   (9M) (CO4)

b) Make the following circuit with the specified component values and measure Thevenin'svoltage across A, B terminals   (15M)(CO2)
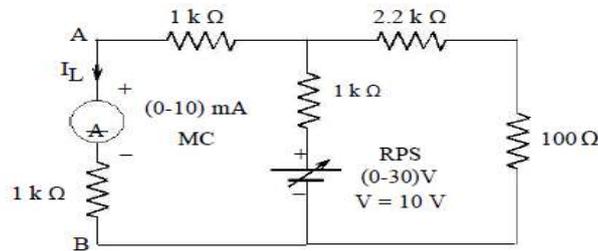
c) Make the following circuit. Conduct an experiment to verify superposition theorem by measuring current through the 1KΩ resistor. Compare this measured value with the theoretical value.   (30M)(CO2)
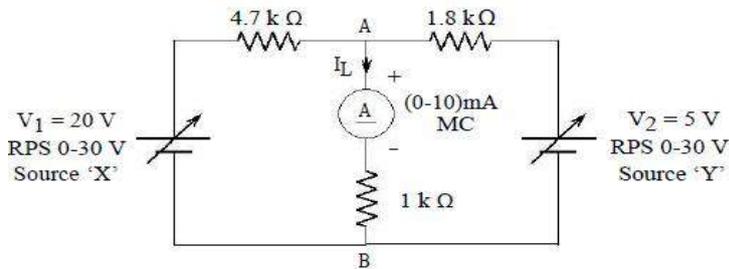
7. a) i) Identify the front panel controls of CRO.
      ii)Identify the front panel controls of Pulse generator.   (9M) (C03)

b) Make the following circuit with the specified component values. Calculate resonance frequency.   (15M) (CO2)
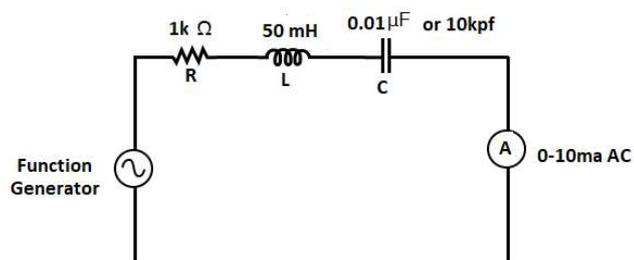
c) Make the following circuit. Measure current through the load resistor by applying Thevenin's theorem. Compare measured load current with the theoretical value.   (30M)(CO2)
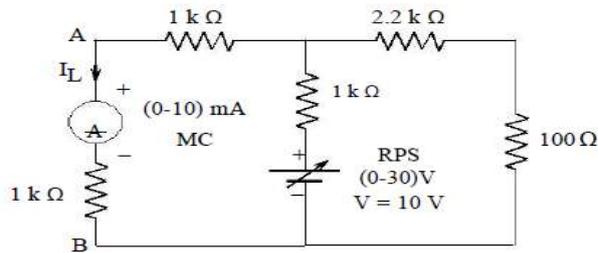
8. (a)   i)Identify the front panel controls of CRO.
          ii) Identify the front panel controls of function generator.   (9M) (C03)
   b)   Make the connection for testing PA system.   (15M)(CO4)

   (c) Calculate Unknown frequency by generating different Lissajous patterns for given 5 KHz input signal.   (30M)(CO3)

9.   a) i) Identify the front panel controls of CRO.
        ii)Identify the front panel controls of Pulse generator.   (9M) (C03)

     b) Make the connection for measuring unknown frequency by using Lissajous pattern on CRO
                                                                                          (15M) (CO3)

     c) Test the given ICs using digital IC tester and specify their working condition   (30M)(CO1)

10.   (a) i) Identify the front panel and rear panel controls of PA System
           ii) Identifying various cables and connectors used in PA system.   (9M) (C04)

       (b) i) Make the connection for measurement of DC Voltage using CRO.
            ii) Make the connection for measurement of AC Voltage using CRO   (15M) (C03)
            (30M)(CO4)
       (c) Arrange the given LCD projector and demonstrate various operating controls in it (30M)(CO4)

11   (a) i)Identify the front panel controls of CRO.
         ii)Identify the front panel controls of Function generator.   (9M) (C03)

     b)Demonstrate recording and reproduction of voice using mobile phone/ or any voice recorder
                                                                                          (15M) (CO4)
     (c) Test the PA system by adjusting different controls knobs on Amplifier.   (30M)(C04)

12. a) Identify different rear panel ports and their function in a given smart TV   (9M) (CO4)
     b) Make the connection for measurement of pulse parameter using CRO.   (15M) (C03)
     c) Measure the resistance, inductance and capacitance of given resistors, inductors and capacitors respectively using LCR meter and compare with their colour coded /marked values.
                                                                                          (30M) (C01)

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