DEMONSTRATION

on

ANALOG ELECTRONICSCIRCUITS LAB

By

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DEPT. OF E.C.E, VEMU IT CHITTOOR

Topics to be discussed

- Vision, Mission, POs, PSOs & PEOs
- Syllabus & Course Outcomes (COs)
- Over view of AC lab
- Major Equipment List
- Lab Physical View
- Safety Precautions
- Dos & Don’t

Vision, Mission, POs, PSOs & PEOs

Vision of the institute

To be a premier institute for professional education producing dynamic and vibrantforce of technocrat with competent skills, innovative ideas and leadership qualities to serve the society with ethical and benevolent approach.

Mission of the institute

Mission_1: To create a learning environment with state-of-the art infrastructure, well equipped laboratories, research facilities and qualified senior faculty to impart high quality technical education.

Mission_2: To facilitate the learners to foster innovative ideas, inculcate competent research and consultancy skills through Industry-Institute Interaction.

Mission_3: To develop hard work, honesty, leadership qualities and sense of direction in rural youth by providing value based education.

Vision of the Department

To become a centre of excellence in the field of Electronics and Communication Engineering and produce graduates with Technical Skills, Research & Consultancy Competencies, Life-long Learning and Professional Ethics to meet the challenges of the Industry and evolving Society.

Mission of the Department

Mission_1: To enrich Technical Skills of students through Effective Teaching and Learning practices for exchange of ideas and dissemination of knowledge.

Mission_2: To enable the students with research and consultancy skill sets through state-of-the art laboratories, industry interaction and training on core & multidisciplinary technologies.

Mission_3: To develop and instill creativethinking, Life-long learning, leadership qualities, Professional Ethics and social responsibilities among students by providing value based education.

Programme Educational Objectives (PEOs)

PEO_1: To prepare the graduates to be able to plan, analyze and provide innovative ideas to investigate complex engineering problems of industry in the field of Electronics and Communication Engineering using contemporary design and simulationtools.

PEO_2: To provide students with solid fundamentals in core and multidisciplinary domain for successful implementation of engineering products and also to pursue higher studies.

PEO_3: To inculcate learners with professional and ethical attitude, effective communication skills, teamwork skills, and an ability to relate engineering issues to broader social context at work place.

Programme Outcome (POs)

PO_1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO_2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO_3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO_4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO_5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO_6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO_7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO_8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO_9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO_10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO_11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO_12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Specific Outcome (PSOs)

PSO_1: Higher Education: Qualify in competitive examinations for pursuing higher education by applying the fundamental concepts of Electronics and Communication Engineering domains such as Analog & Digital Electronics, Signal Processing, Communication & Networking, Embedded Systems, VLSI Design and Control Systems etc..

PSO_2: Employment: Get employed in allied industries through their proficiency in program specific domain knowledge, specialized software packages and Computer programming or become an entrepreneur.

Syllabus & Course Outcomes (COs)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Electronics and Communication Engineering

II B.Tech II-Sem (E.C.E)

(20A54302P)Analog Circuits

Course Outcomes:

C218.1: Analyze the single and multistage amplifiers at low, mid and high frequencies using simulation software and Hardware.

C218.2: Analyze the transistor oscillators using simulation software and Hardware.

C218.3: Determine the efficiencies of power amplifiers using simulation software and Hardware.

PART A: List of Experiments :(Minimum of Ten Experiments has to be performed)

- Determination of f_T of a given transistor.
- Voltage-Series Feedback Amplifier
- Current-Shunt Feedback Amplifier
- RC Phase Shift/Wien Bridge Oscillator
- Hartley/Colpitt's Oscillator
- Two Stage RC Coupled Amplifier
- Darlington Pair Amplifier
- Bootstrapped Emitter Follower
- Class A Series-fed Power Amplifier
- Transformer-coupled Class A Power Amplifier
- Class B Push-Pull Power Amplifier
- Complementary Symmetry Class B Push-Pull Power Amplifier
- Single Tuned Voltage Amplifier
- Double Tuned Voltage Amplifier

PART B: Equipment required for Laboratory

Software:

- Multisim/ Pspice/Equivalent Licensed simulation software tool
- Computer Systems with required specifications

VEMU INSTITUTE OF TECHNOLOGY::P.KOTHAKOTA
NEAR PAKALA, CHITTOOR-517112
(Approved by AICTE, New Delhi & Affiliated to JNTUA, Anantapuramu)
Department of Electronics &Communication Engineering
LIST OF EXPERIMENTS TO BE CONDUCTED

PART A: List of Experiments (Software)

- Voltage-Series Feedback Amplifier
- Current-Shunt Feedback Amplifier
- RC Phase Shift/Wien Bridge Oscillator
- Hartley/Colpitt's Oscillator
- Two Stage RC Coupled Amplifier
- Darlington Pair Amplifier
- Class A Series-fed Power Amplifier
- Class B Push-Pull Power Amplifier
- Complementary Symmetry Class B Push-Pull Power Amplifier

PART B: List of Experiments (Hardware)

- Single Tuned Voltage Amplifier
- Voltage-Series Feedback Amplifier
- Current-Shunt Feedback Amplifier
- RC Phase Shift/Wien Bridge Oscillator
- Hartley/Colpitt's Oscillator
- Two Stage RC Coupled Amplifier
- Darlington Pair Amplifier
- Class A Series-fed Power Amplifier
- Class B Push-Pull Power Amplifier
- Complementary Symmetry Class B Push-Pull Power Amplifier
- Single Tuned Voltage Amplifier

Additional Experiments

- Source Follower with Bootstrapped Circuit
- Fixed bias amplifier circuit using BJT

WHAT IS ECA

Electronic Circuit Analysis – Laboratory :-The students are required to design the electronic circuit and they have to perform the simulation using Multisim/ Pspice/Equivalent Licensed simulation software tool. Further they are required to verify the result using necessary hardware in the hardware laboratory

DRB (Decade resistance Box)

A Decade Resistance Box is a type of test equipment that can be used to substitute the interchanging of different values of certain passive components with a single variable output.

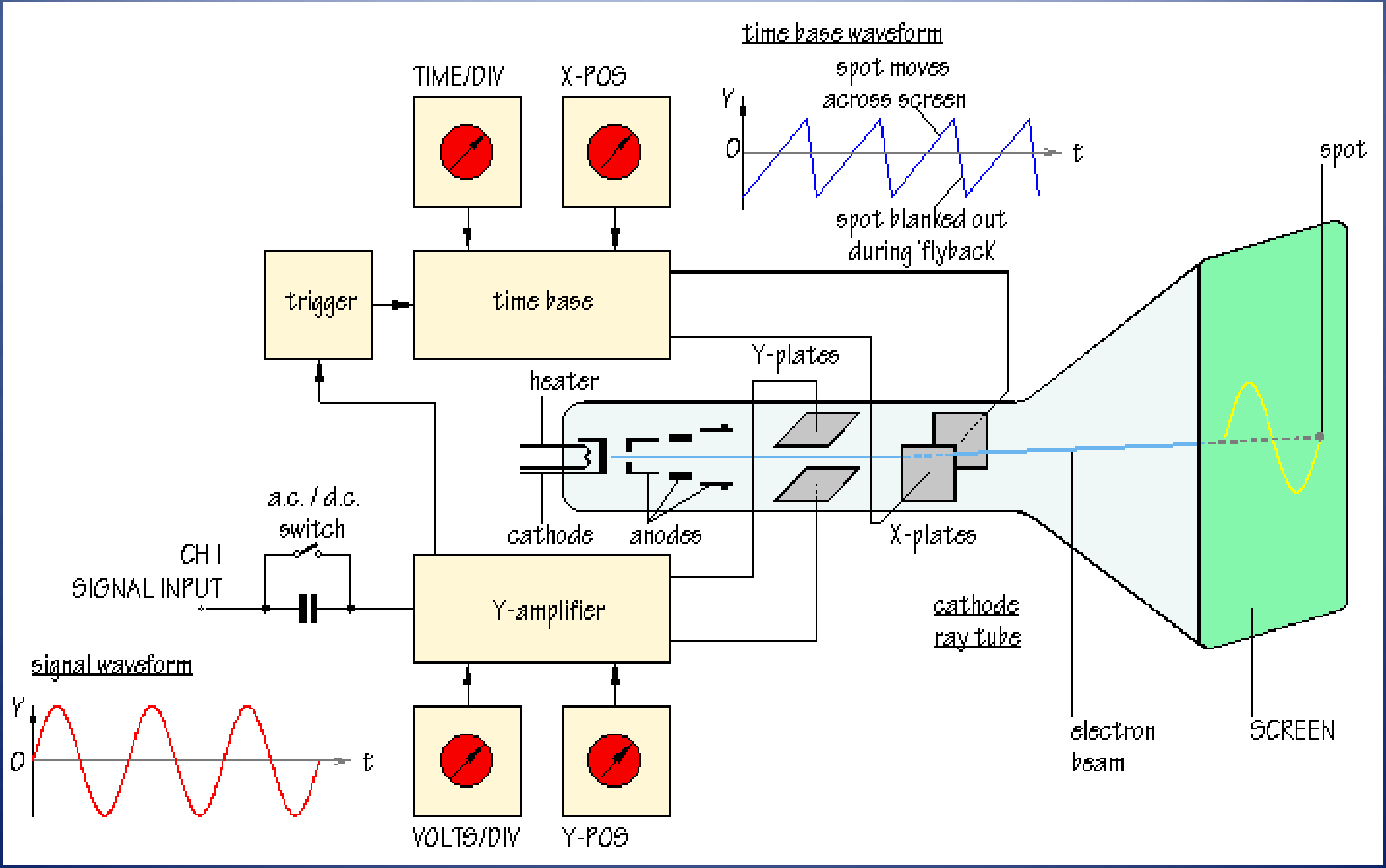
DIB (Decade Inductance Box)

Decade Inductance box are test instruments to simulate very specific electrical values. They can be quickly and easily substituted into a circuit and replace any standard value component.

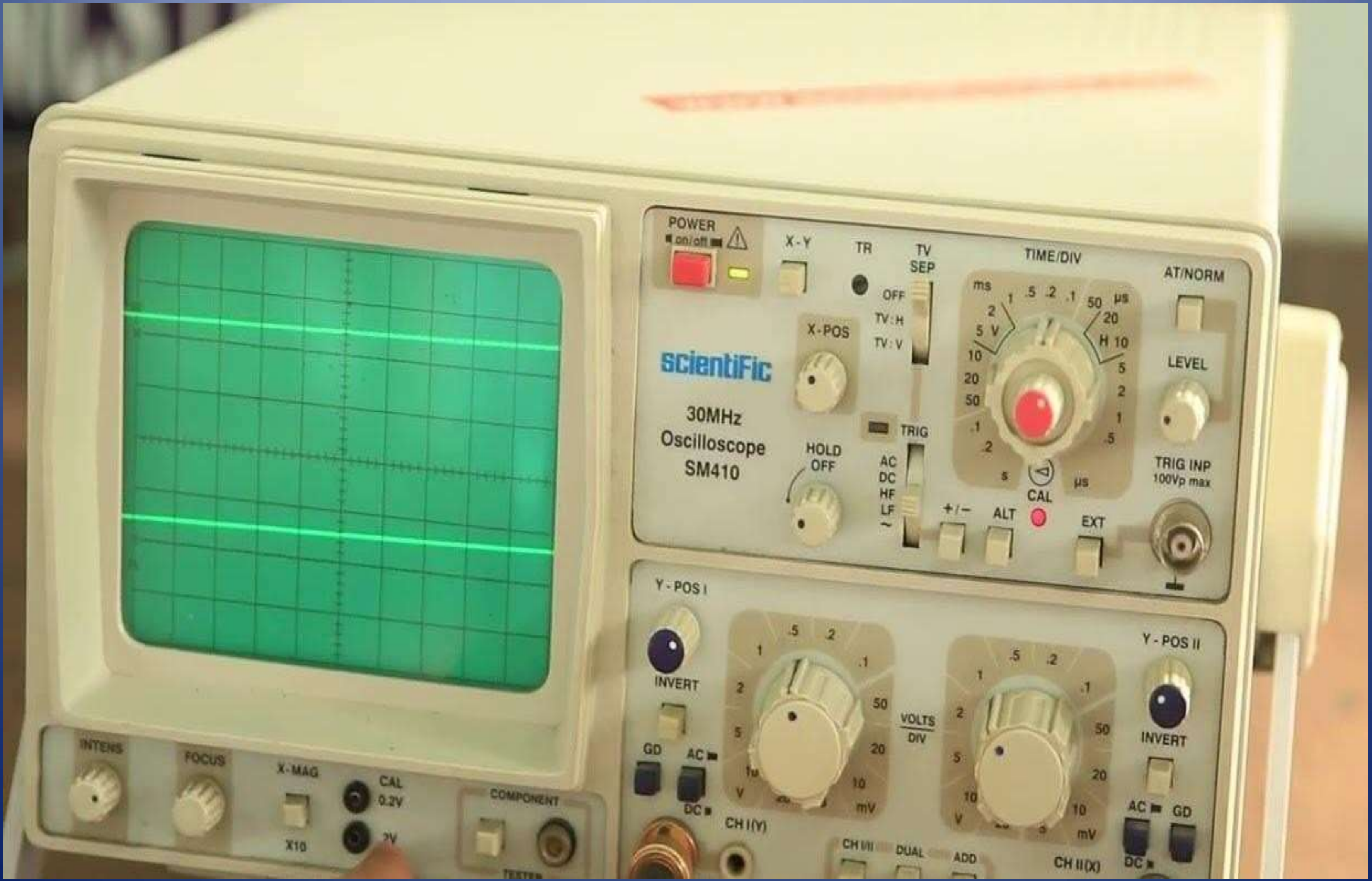
DCB (Decade Capacitance Box)

Decade capacitance box are test instruments to simulate very specific electrical values. They can be quickly and easily substituted into a circuit and replace any standard value component.

Cathode ray Oscilloscope



ANALOG CATHODE RAY OSCILLOSCOPE



Analog Oscilloscope (CRO)

An oscilloscope displays time-varying signals like voltage waveform patterns on a screen which help in visualizing the circuit functions. While the basic models .

FUNCTION GENERATOR

FUNCTION GENERATOR

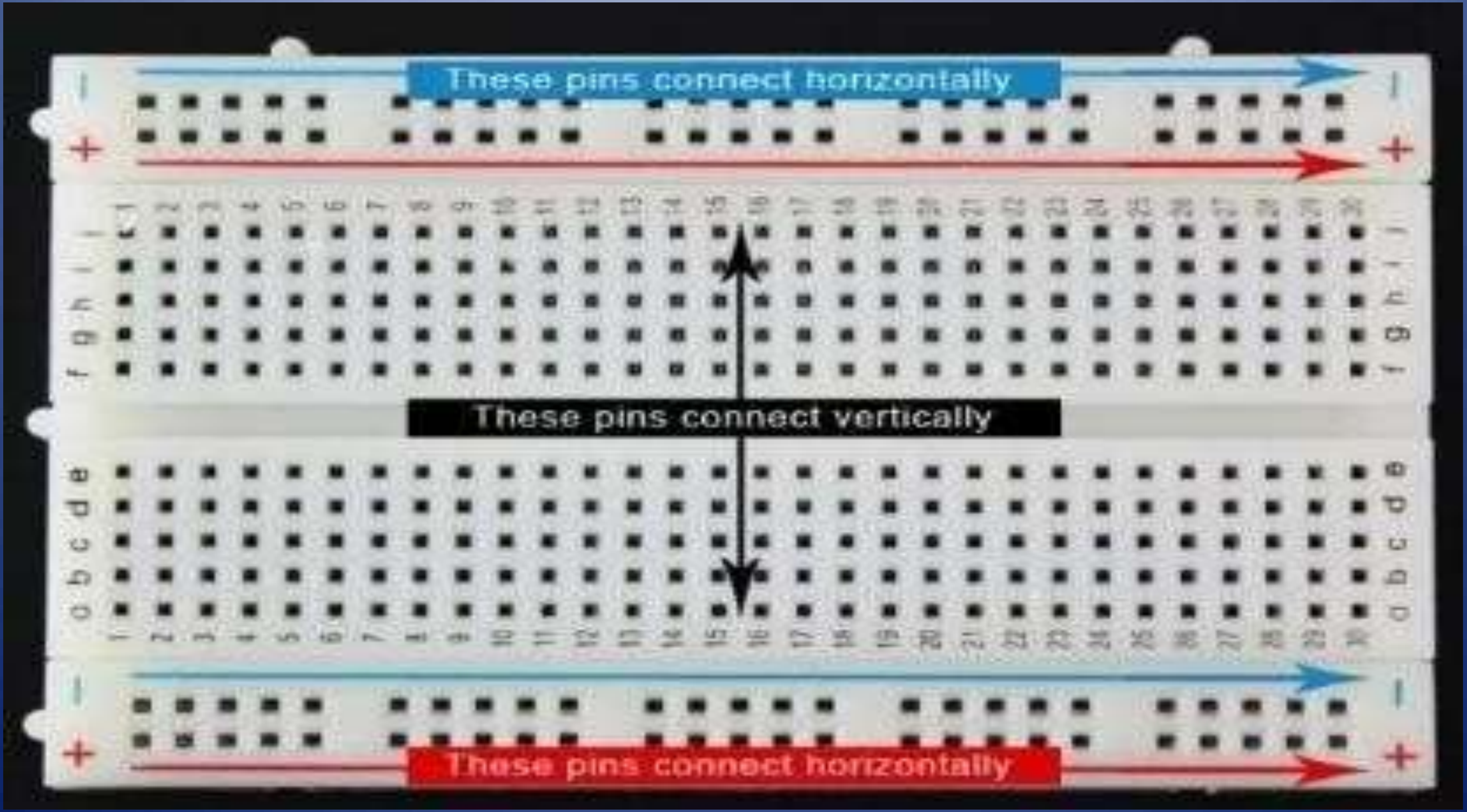
- **Function generator :**
- A function generator is usually a piece of electronic test equipment or soft ware used to generate different types of electrical waveforms over a wide range of frequencies. Some of the most common waveforms produced by the function generator are the sine wave , square wave, triangular wave and sawtooth shapes. These waveforms can be either repetitive or single-shot

REGULATED POWER SUPPLY

REGULATED POWER SUPPLY

- **Power supplies:**
- A power supply is an electrical device that supplies electric power to an electrical load. The primary function of a power supply is to convert electric current from a source to the correct voltage, current, and frequency to power the load. As a result, power supplies are sometimes referred to as electric power converters

BREAD BOARD


These pins connect horizontally
These pins connect vertically
These pins connect horizontally

BREAD BOARD

Breadboards:

- In order to temporarily construct a circuit without damaging the components used to build it, we must have some sort of a platform that will both hold the components in place and provide the needed electrical connections. In the early days of electronics, most experimenters were amateur radio operators. They constructed their radio circuits on wooden
- breadboards. Although more sophisticated techniques and devices have been developed to make the assembly and testing of electronic circuits easier, the concept of the breadboard still remains in assembling components on a temporary platform.

AMMETER

AMMETER

- An ammeter (from Ampere Meter) isa measuring instrument used to measure the current in a circuit. Electric currents are measured in amperes (A), hence the name. Instruments used to measure smaller currents, in the milli ampere or microampere range, are designated as milli-ammeters or micro-ammeters

VOLT METER

VOLT METER

- A voltmeter is an instrument used for measuring electrical potential difference between two points in an electric circuit. Analog voltmeters move a pointer across a scale in proportion to the voltage of the circuit; digital voltmeters give a numerical display ofvoltage by use of an analog to digital converter.

DIGITAL MULTI METER

DIGITAL MULTI METER

- A multimeter is quite important as it measures voltage, current, resistance, and other aspects of electricity and circuits. Usually, these are small in size, run on batteries, and carry large digital displays. There is also a knob to select the measurement function and a pair of test leads for connecting the device to the circuit.

TRANSITORS

- A **transistor** is a semiconductor device used to amplify or switch electronic signals and electrical power. It is composed of semiconductor material usually with at least three terminals for connection to an external circuit.

TYPES OF TRANSISTORS

- BI-POLAR JUNCTION TRANSISTORS (BJT)

  N-P-N TRANSISTOR &

  P-N-P TRANSISTOR

- UNI-POLAR JUNCTION TRANSISTORS (UJT)

  Ex: FIELD EFFECT TRANSISTOR(FET)

  JFET & MOSFET

Amplifier

- Amplifier:- An Amplifier, is an electronic device that increase the power of a signal.

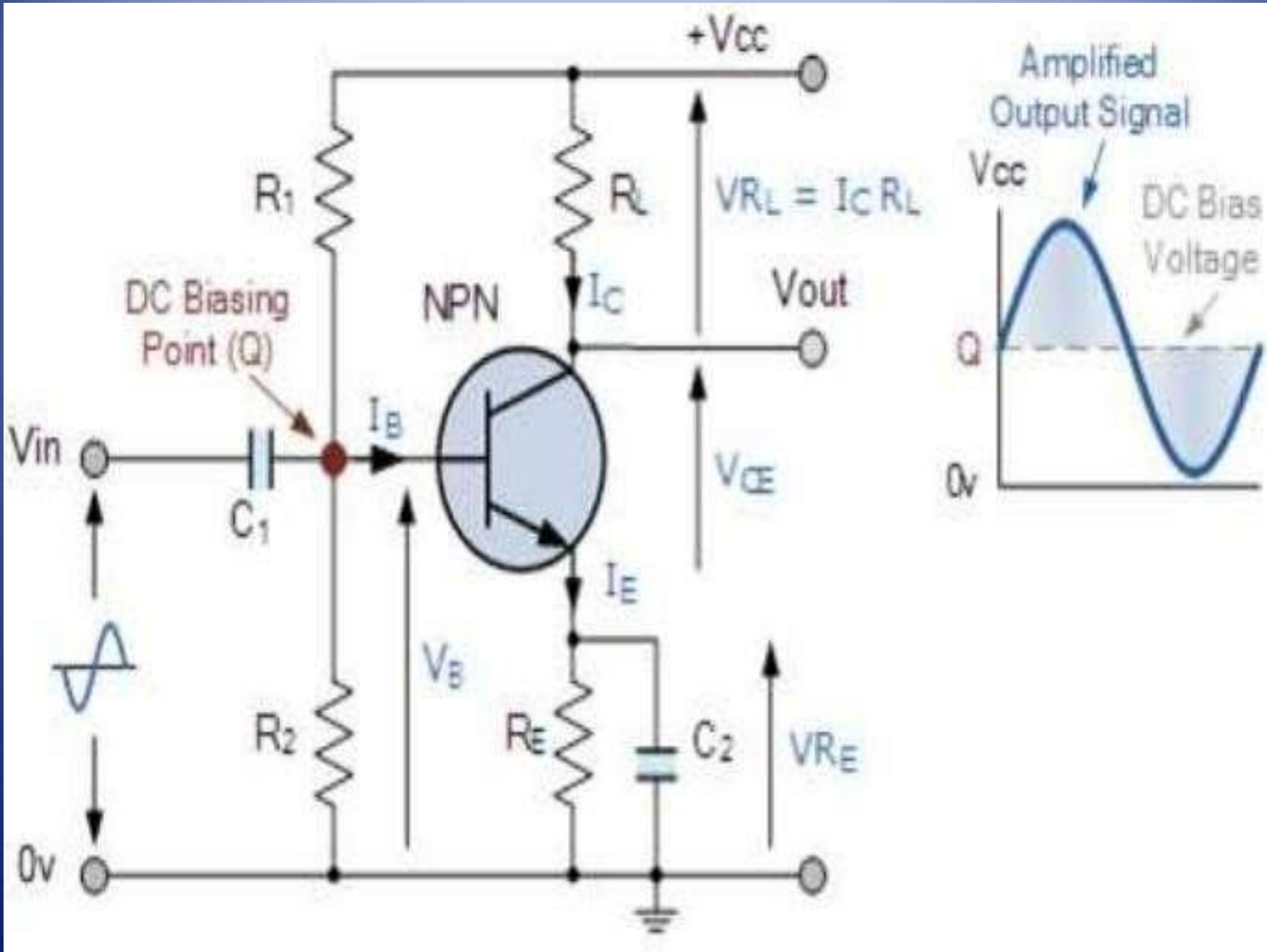
- It does this by taking energy from a power supply and controlling the output to match the input signal shape but with a larger amplitude.
- In this sense, an amplifier modulates the output of the power supply to make the output signal stronger than the input signal.

TYPES OF AMPLIFIER

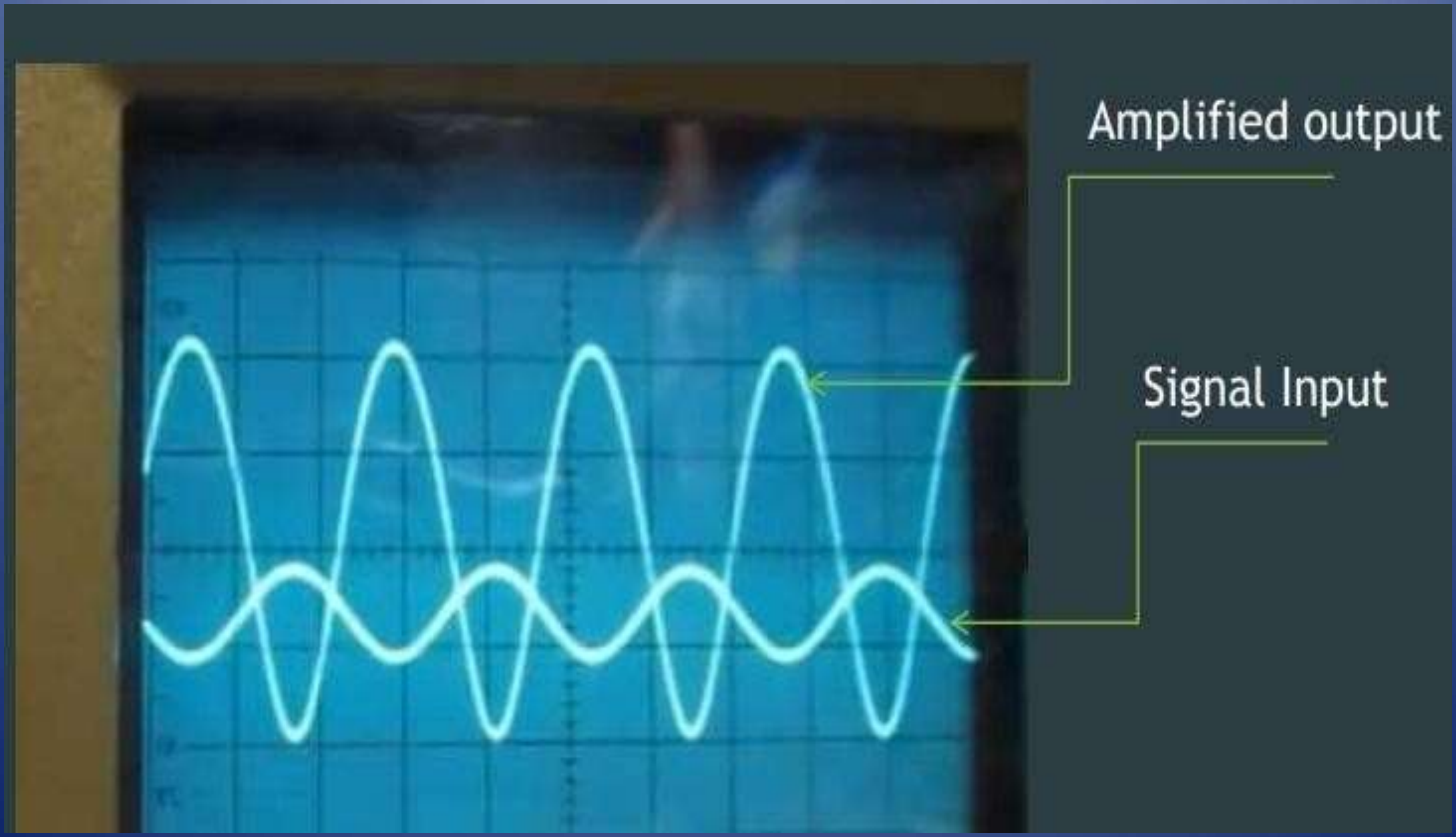
- There are Basically Four Types of Amplifier.

1. Voltage Amplifier
2. Current Amplifier
3. Transconductance
4. Transresistance

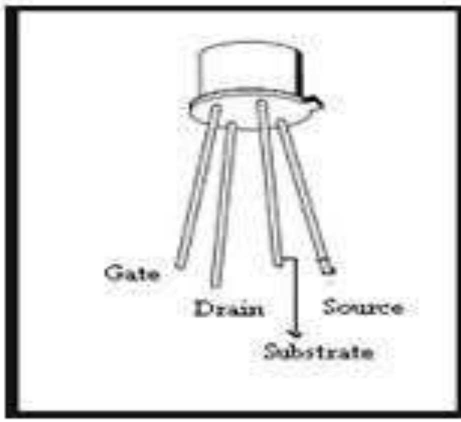
- Common Base, Common Emitter and Common Collector are the Configurations of the Amplifier.

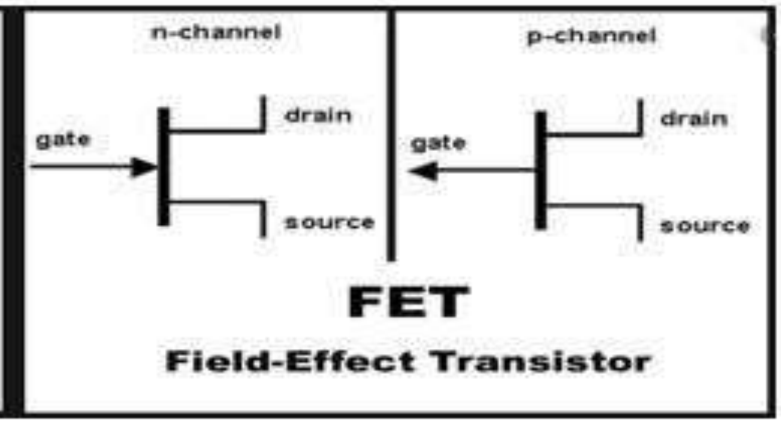

+Vcc
Amplified
Output Signal
Vcc
DC Bias
Voltage
R1
RL
VRL = IC RL
DC Biasing
Point (Q)
NPN
IC
Vout
Q
IB
Vin
C1
VCE
0v
IE
VB
R2
RE
C2
VRE
0v

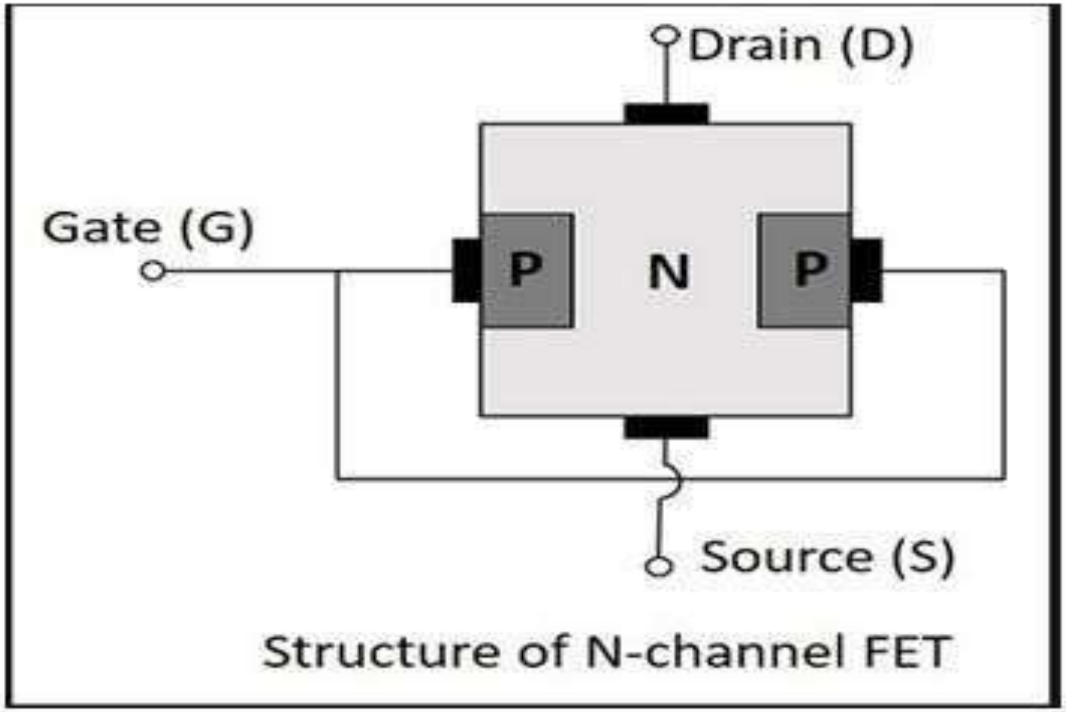
Experimental Output of CE



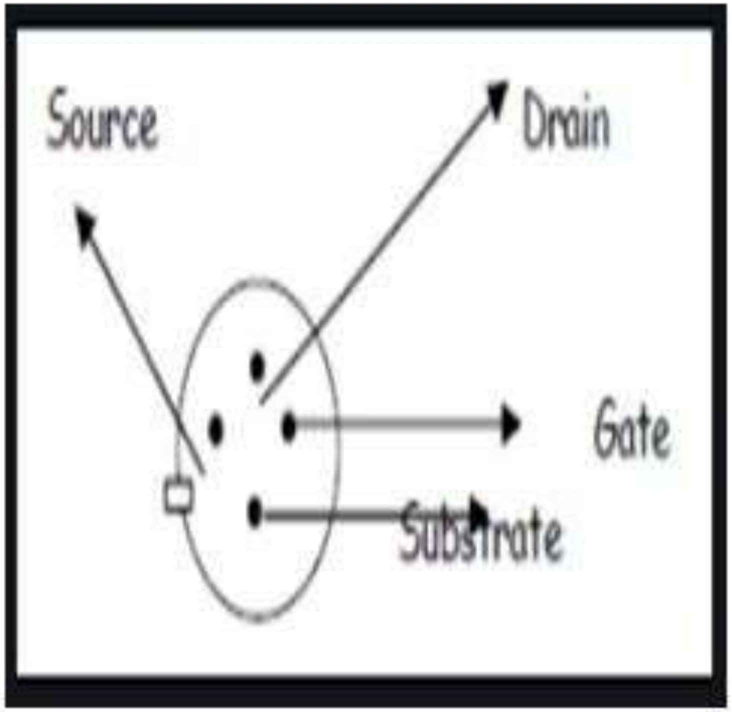
FET (Field Effect Transistor)







Structure of N-channel FET

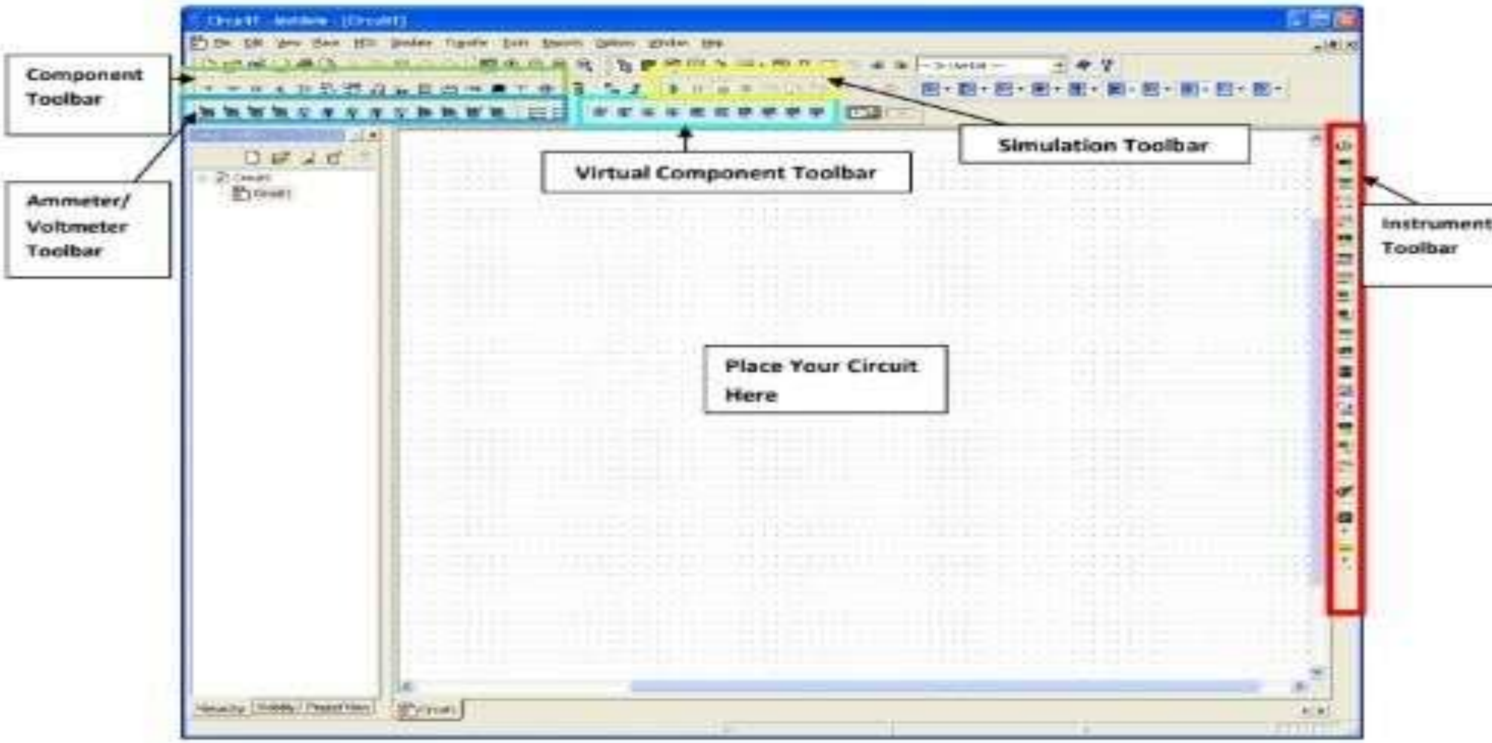


Bipolar transistors are so **named** because they conduct by using both majority and minority carriers. The **field-effect transistor** (**FET**), sometimes **called** a unipolar transistor, uses either electrons (in N-channel **FET**) or holes (in P-channel **FET**) for conduction. ... There are fields inside of a BJT

Using Multisim Software Procedure

Start

Click on Start ⟶ All Programs ⟶ National Instruments ⟶ Circuit Design Suite 10.0 ⟶ Multisim.



1. **Open/Create Schematic**

A blank schematic Circuit 1 is automatically created. To create a new schematic click on File – New – Schematic Capture. To save the schematic click on **File /Save As**. To open an existing file click on **File/ Open** in the toolbar.

2. **Place Components**

To Place Components click on **Place/Components.** On the Select Component Window click on **Group** to select the components needed for the circuit. Click OK to place the component on the schematic.

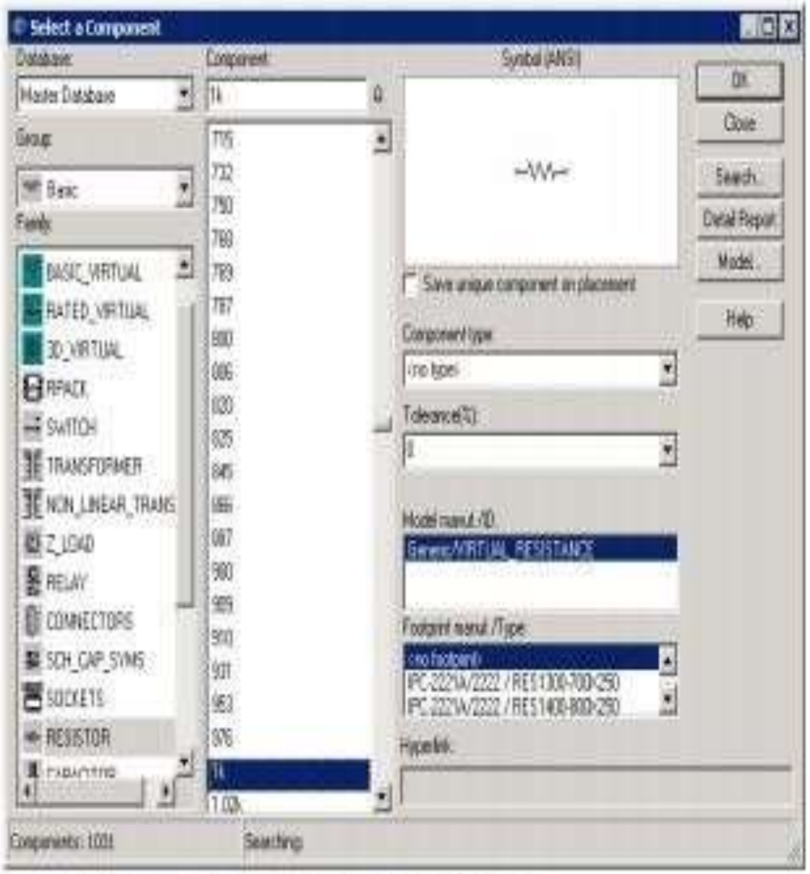


Figure 1: Select Resistor

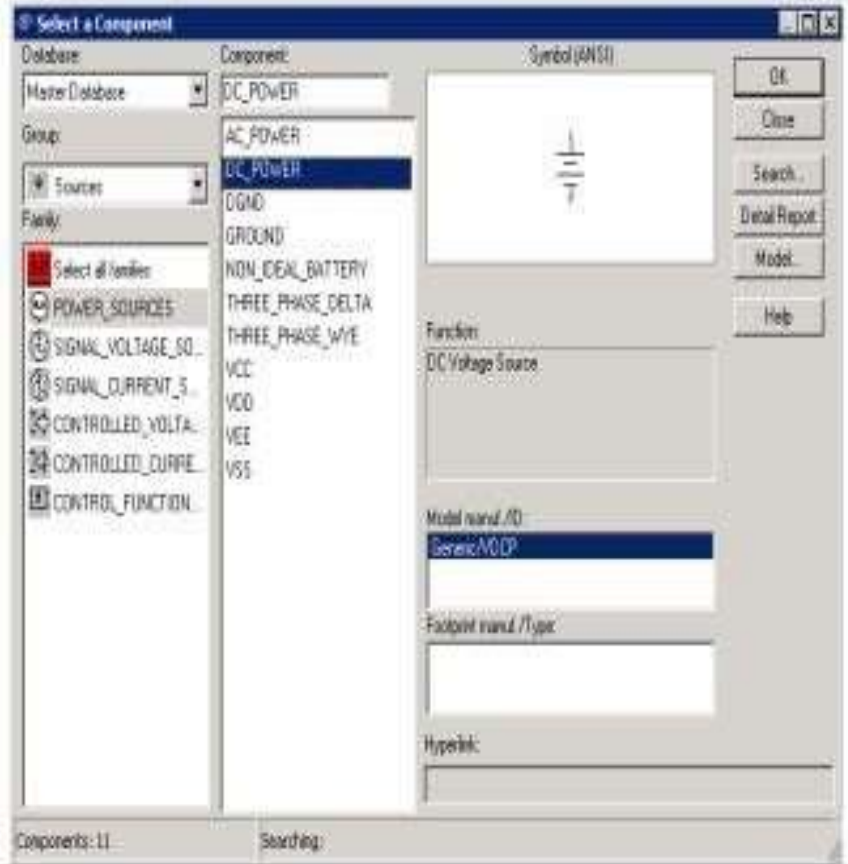
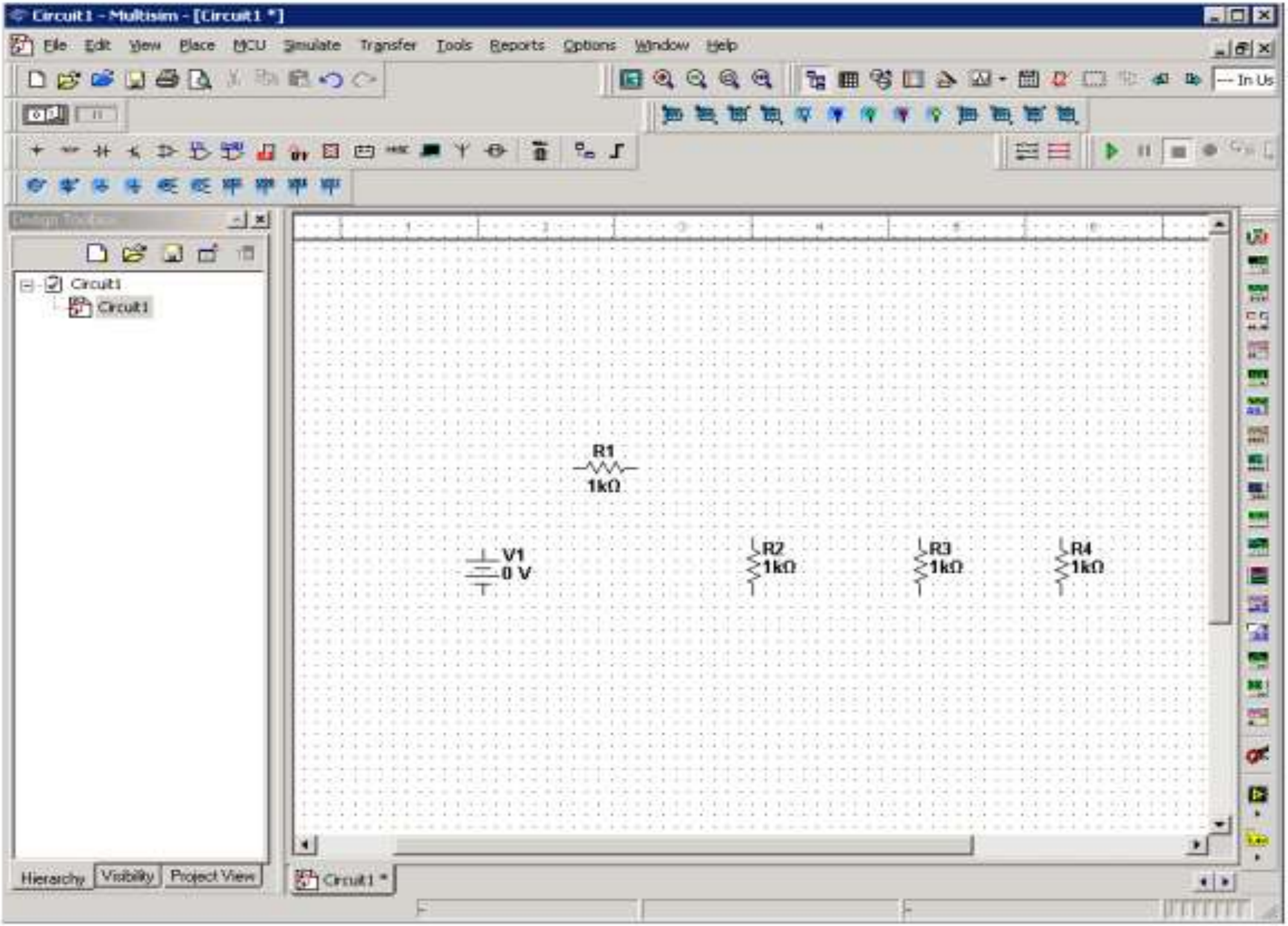


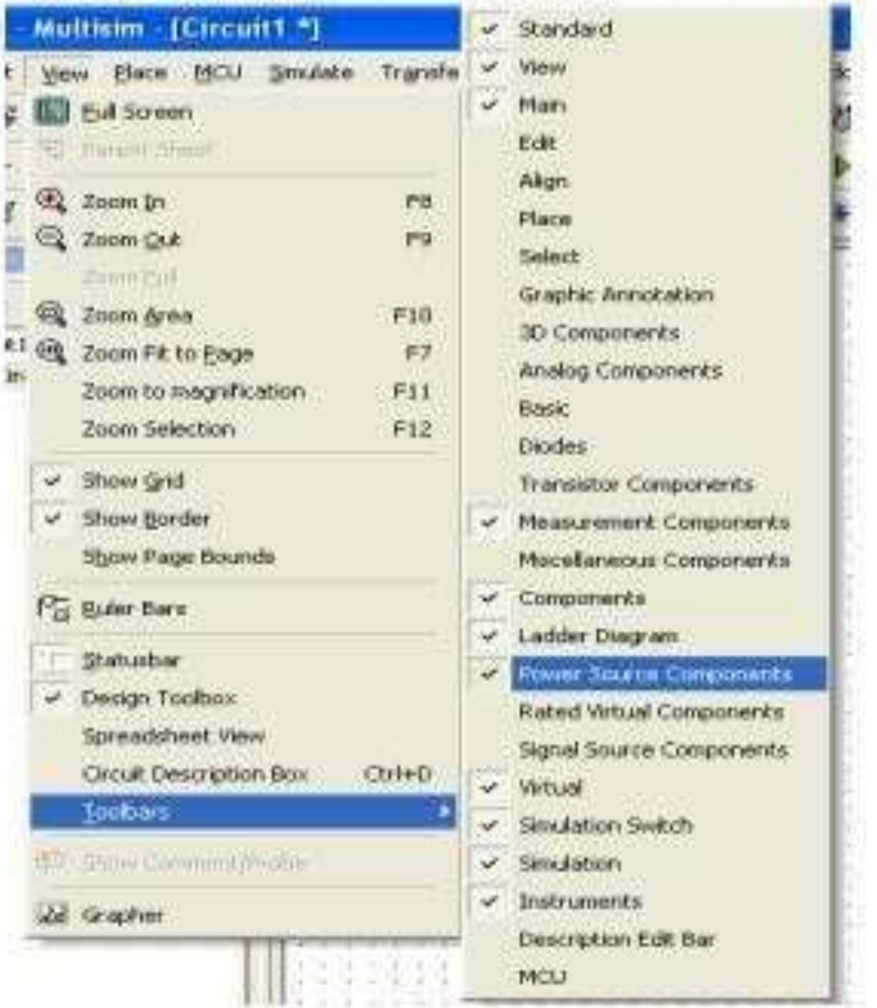
Figure 2: Select DC voltage

For example to select resistors and the DC source shown in Figure 3 click on **Place/ Components**. In **Group** select **Basic** scroll down to Resistors and select the value of the resistor needed to construct the circuit, for this example select 1k. To place DC source click on Sources in **Group** and select DC Source. As shown in Figure 1 and Figure 2 respectively.


Circuit1 - Multisim - [Circuit1 *]
File Edit View Place MCU Simulate Transfer Tools Reports Options Window Help
Circuit1
Circuit1
R1
1kΩ
V1
0 V
R2
1kΩ
R3
1kΩ
R4
1kΩ
Hierarchy
Visibility
Project View
Circuit1 *

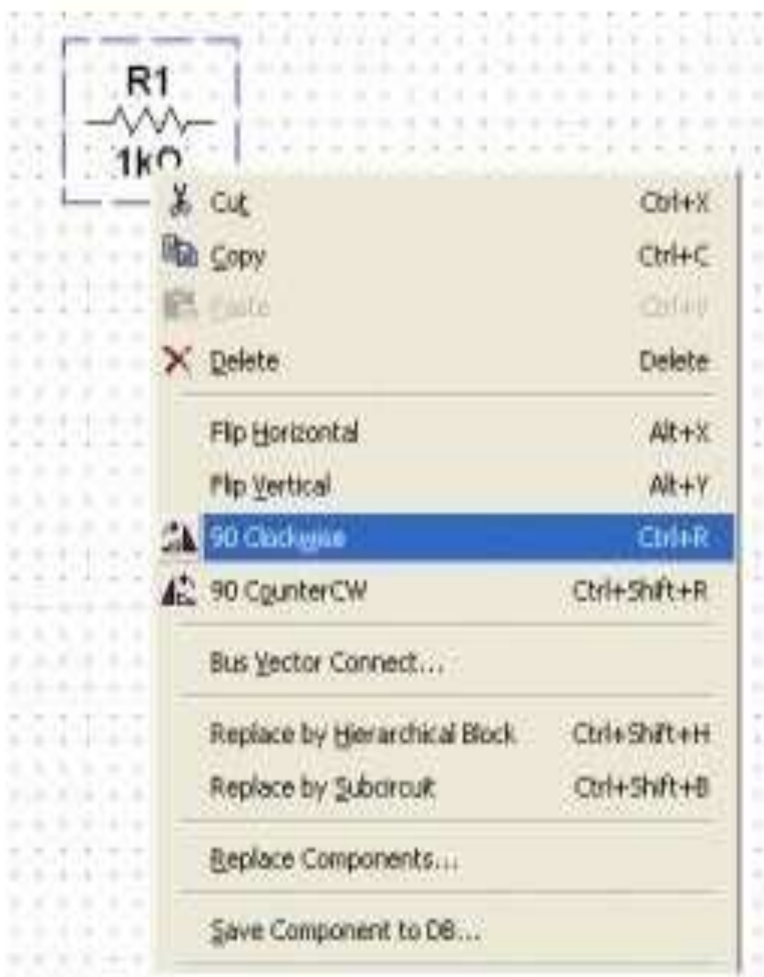
Virtual Components

Components can also be place on the circuit using **Virtual components**. Click on View – Toolbars and select the toolbar needed for the circuit.



4. Rotate Components

To rotate the components right click on the Resistor to flip the component on 90 Clockwise (Ctrl +R) and 90 Counter Clockwise (Ctrl+Shift+R).



5. Place Wire/Connect Components

To connect resistors click on **Place/Wire** drag and place the wire. Components can also be connected by clicking the mouse over the terminal edge of one component and dragging to the edge of another component. Reference Figure 6.

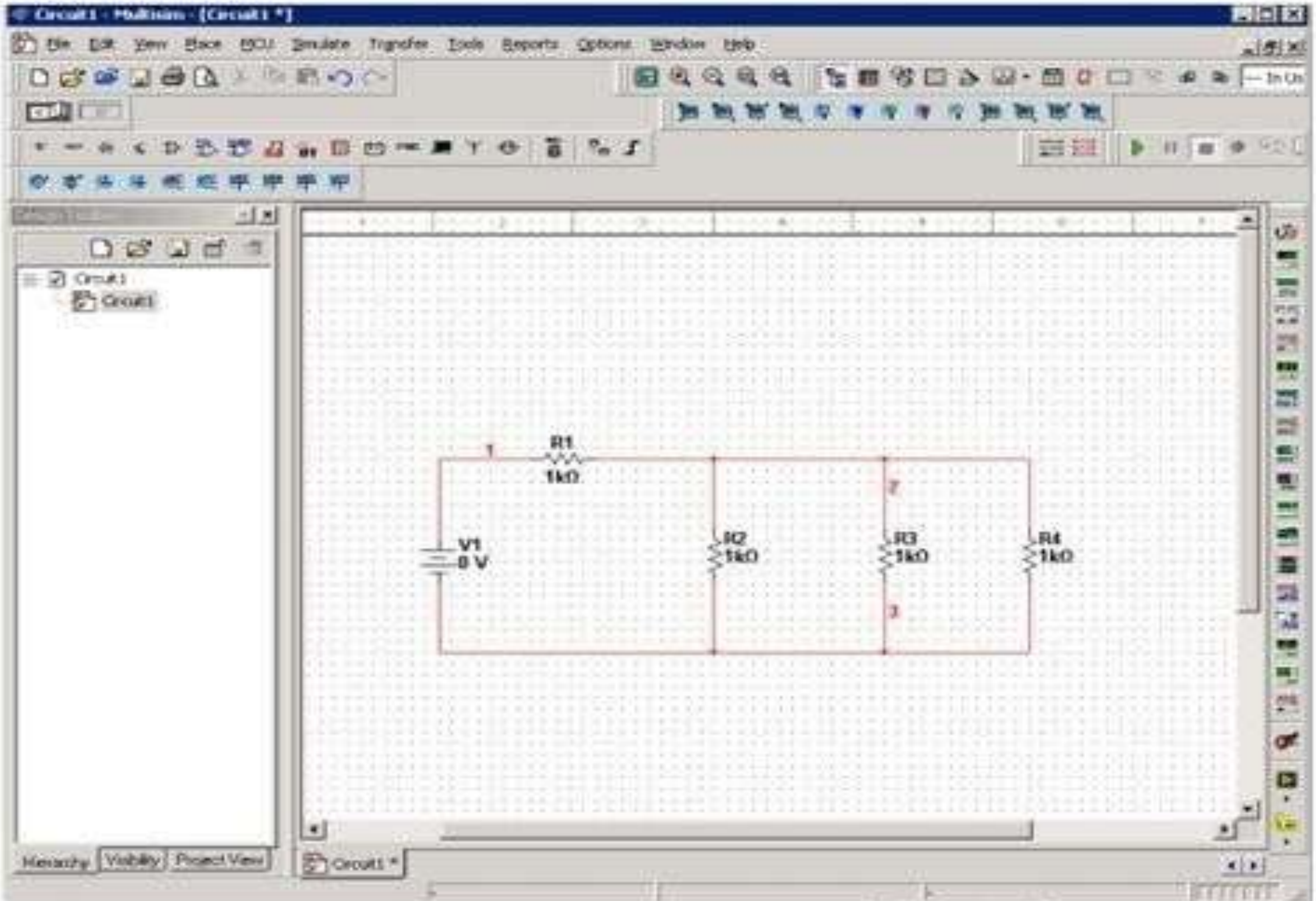
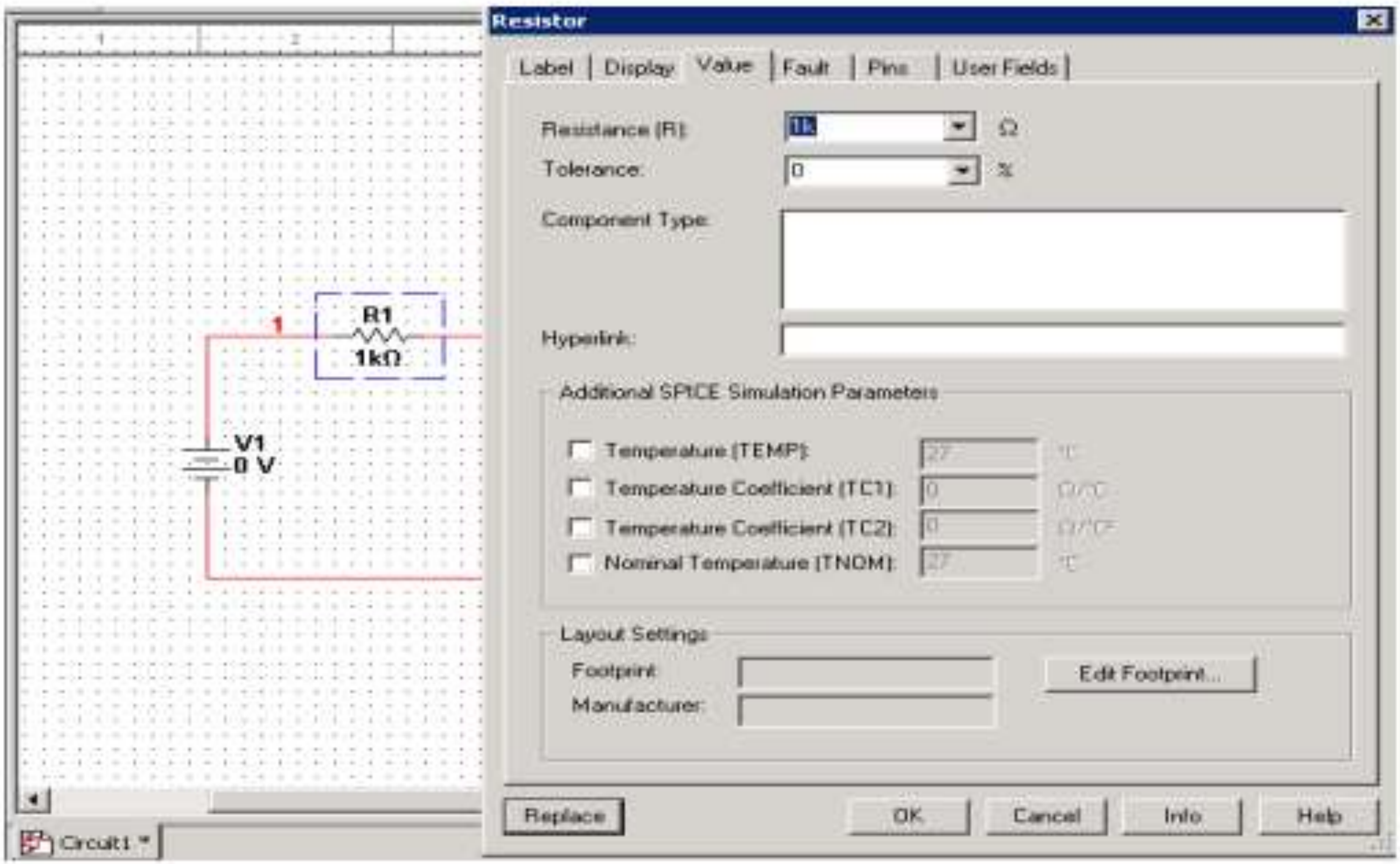


Figure 6: Place/ Wire

6. Change Component Values

To change component values double click on the component this brings up a window that display the properties of the component. Reference Figure 7. Change R1 from 1k Ohm to 10 Ohms, R2 to 20 Ohms, R3 to 30 Ohms, and R4 to 40 Ohms. Also change the DV source from 0 V to 20 V. Figure 8 shows the completed circuit



8. Simulation:

To simulate the completed circuit Click on **Simulate/Run** or **F5.** This feature can also be accessed from the toolbar as shown in the Figure 10 below.

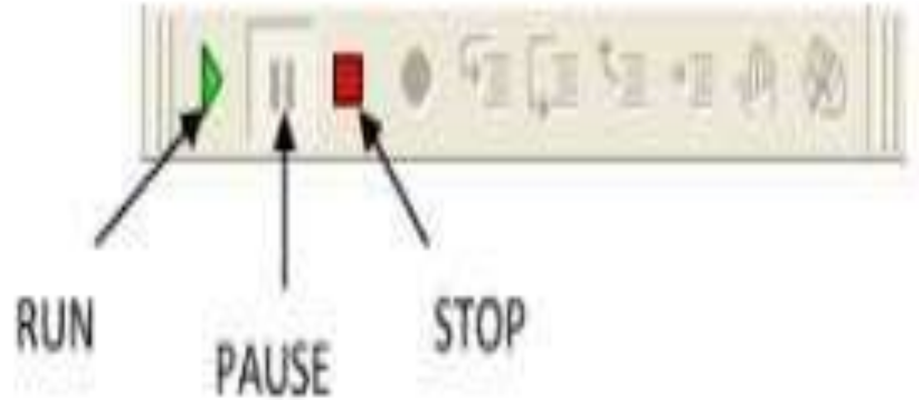


Figure 10: Simulation

To measure Voltage place multimeter in Parallel with the component (Resistor, Voltage etc). To measure Current place the multimeter in series with the component. Reference the Figure 12 and 13.

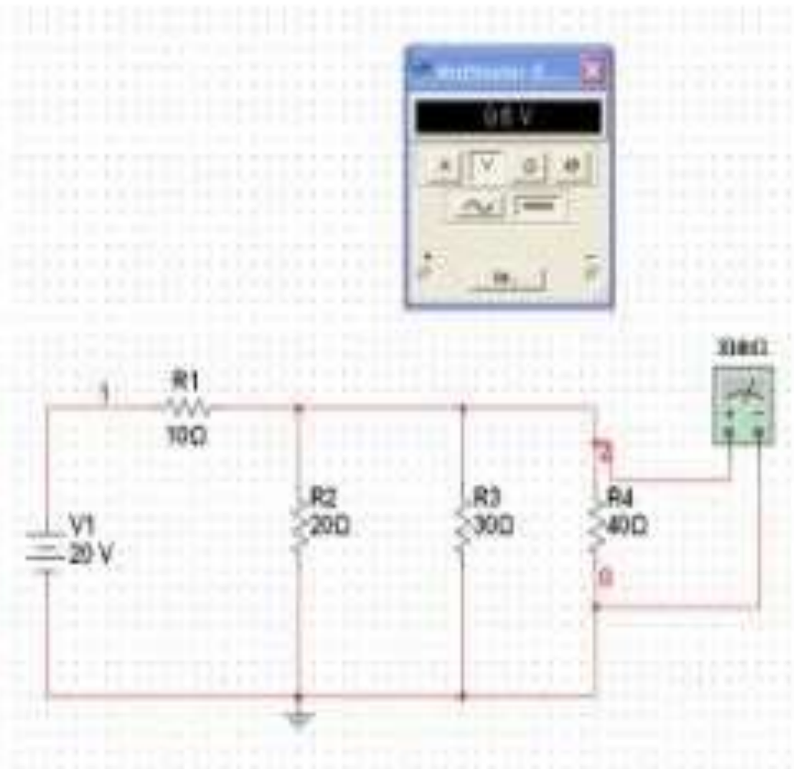


Figure 12: Measure Voltage

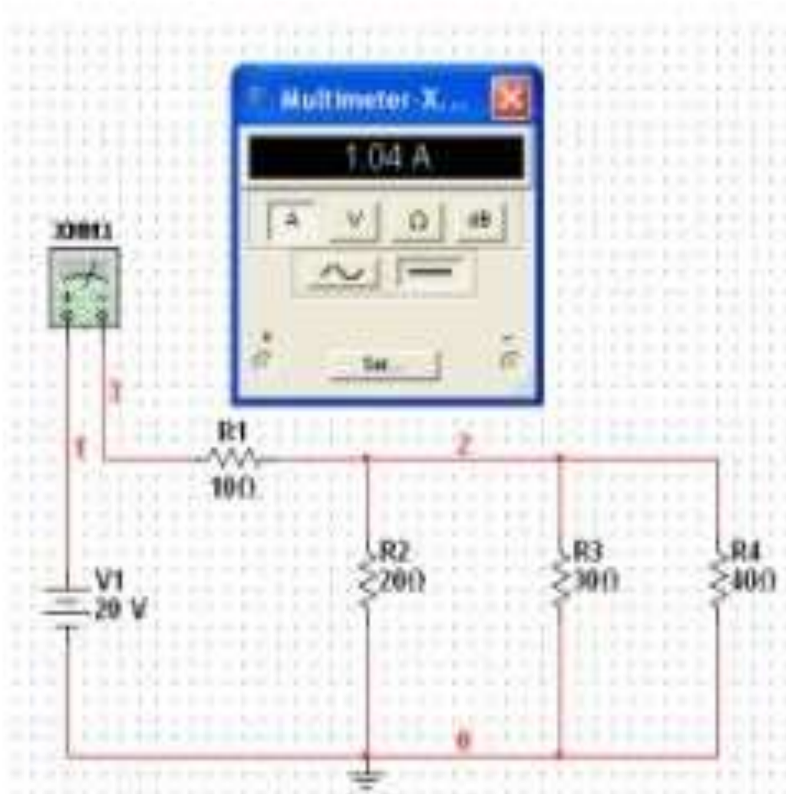


Figure 13: Measure Current

Analyzing Components

Multisim offers multiple ways to analyze the circuit using virtual instruments. Some of the basic instruments needed for this lab are described below.

1) **Multimeter**
   Use the Multimeter to measure AC or DC voltage or current, and resistance or decibel loss between two nodes in a circuit. To use the Multimeter click on the Multimeter button in the **Instruments** toolbar and click to place its icon on the workspace. Double-click on the icon to open the instrument face, which is used to enter settings and view measurements.

Figure 11: Multimeter

2) Wattmeter

The wattmeter measures power. It is used to measure the magnitude of the active power, that is, the product of the voltage difference and the current flowing through the current terminals in a circuit.

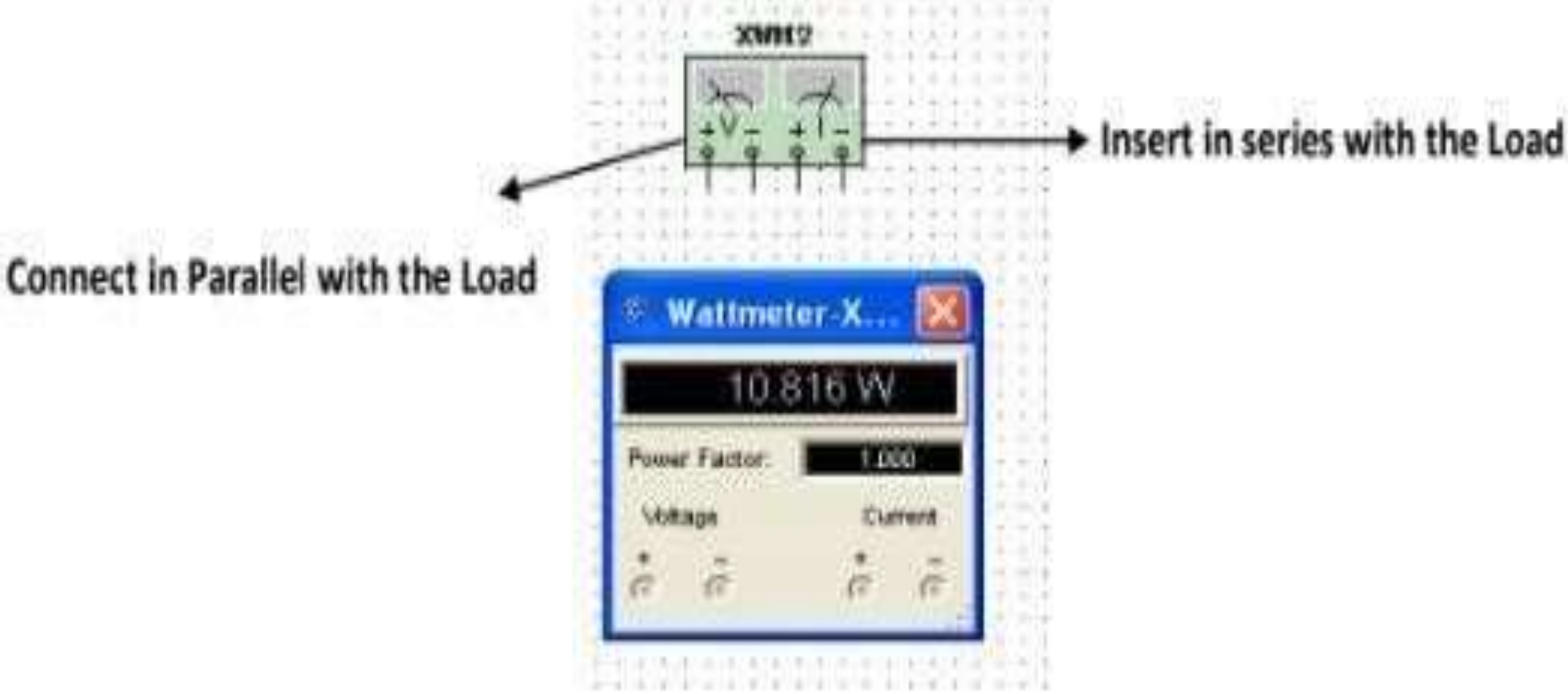


Figure 14: Wattmeter

To use the instrument, click on the Wattmeter button in the **Instruments** toolbar and click to place its icon on the workspace. The icon is used to wire the Wattmeter to the circuit. Double-click on the icon to open the instrument face, which is used to enter settings and view measurements. Reference Figure 15 for more details.

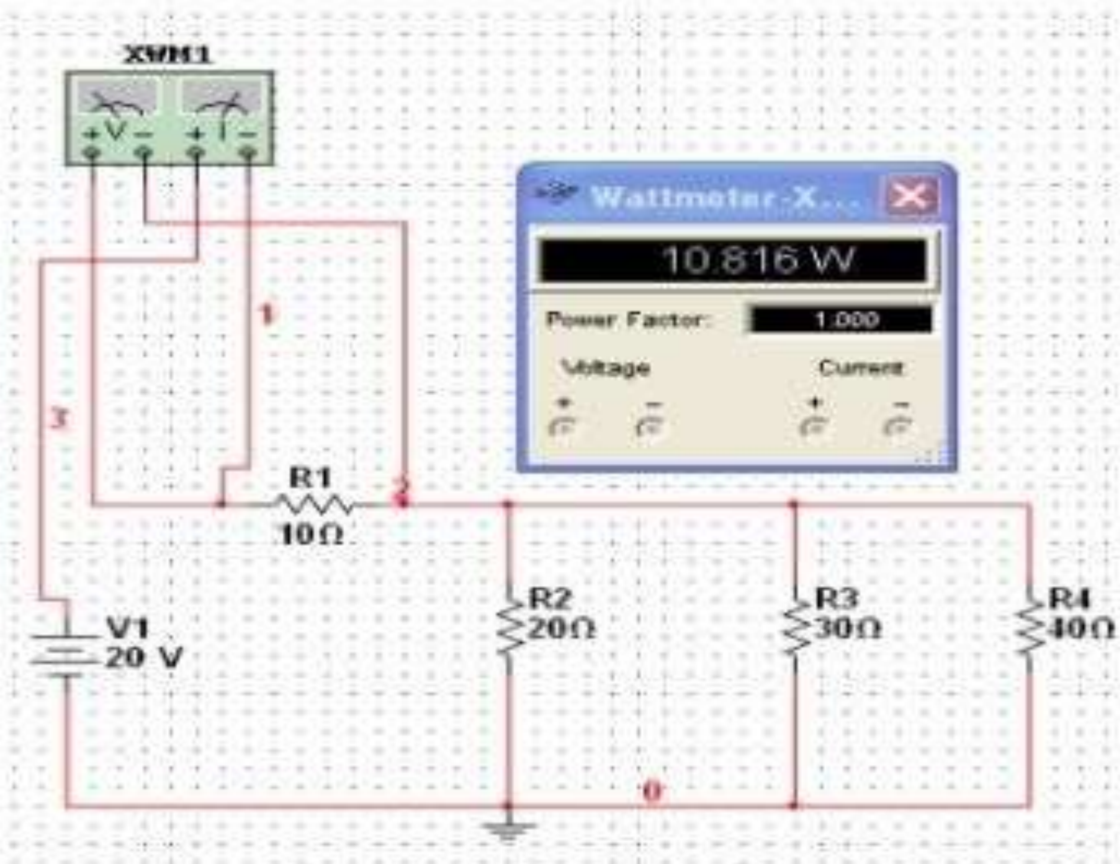


Figure 15: Wattmeter Connection

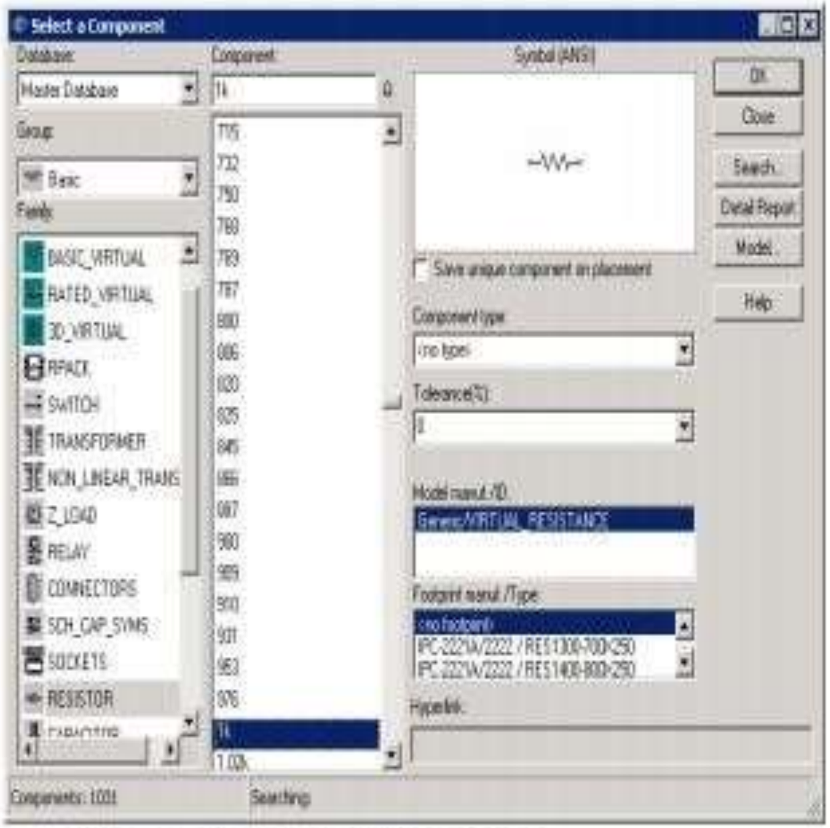


Figure 1: Select Resistor

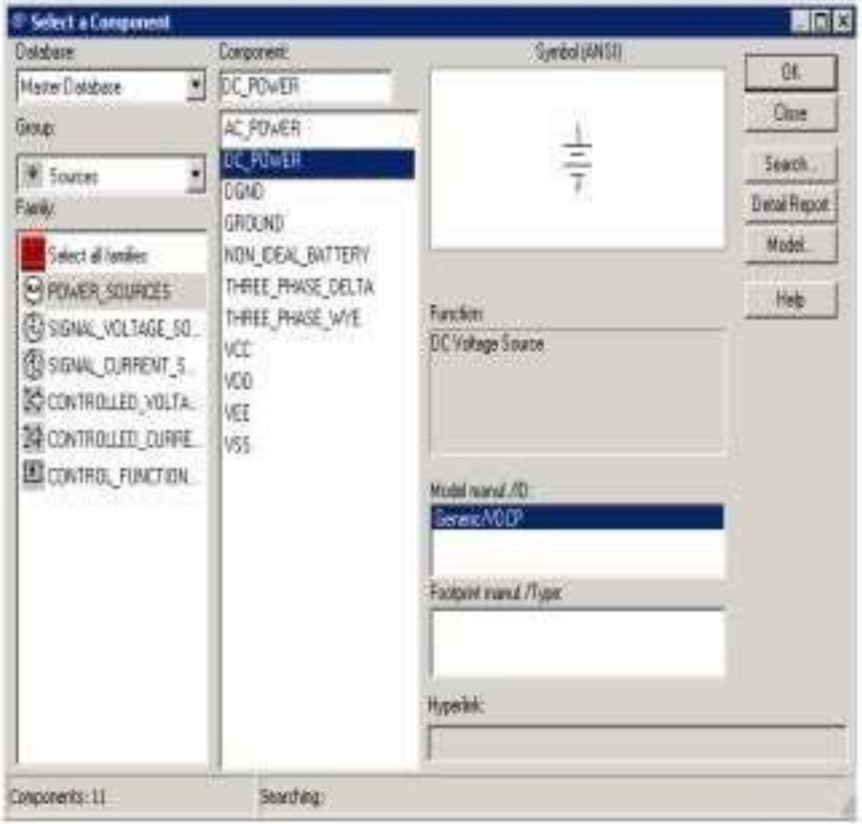
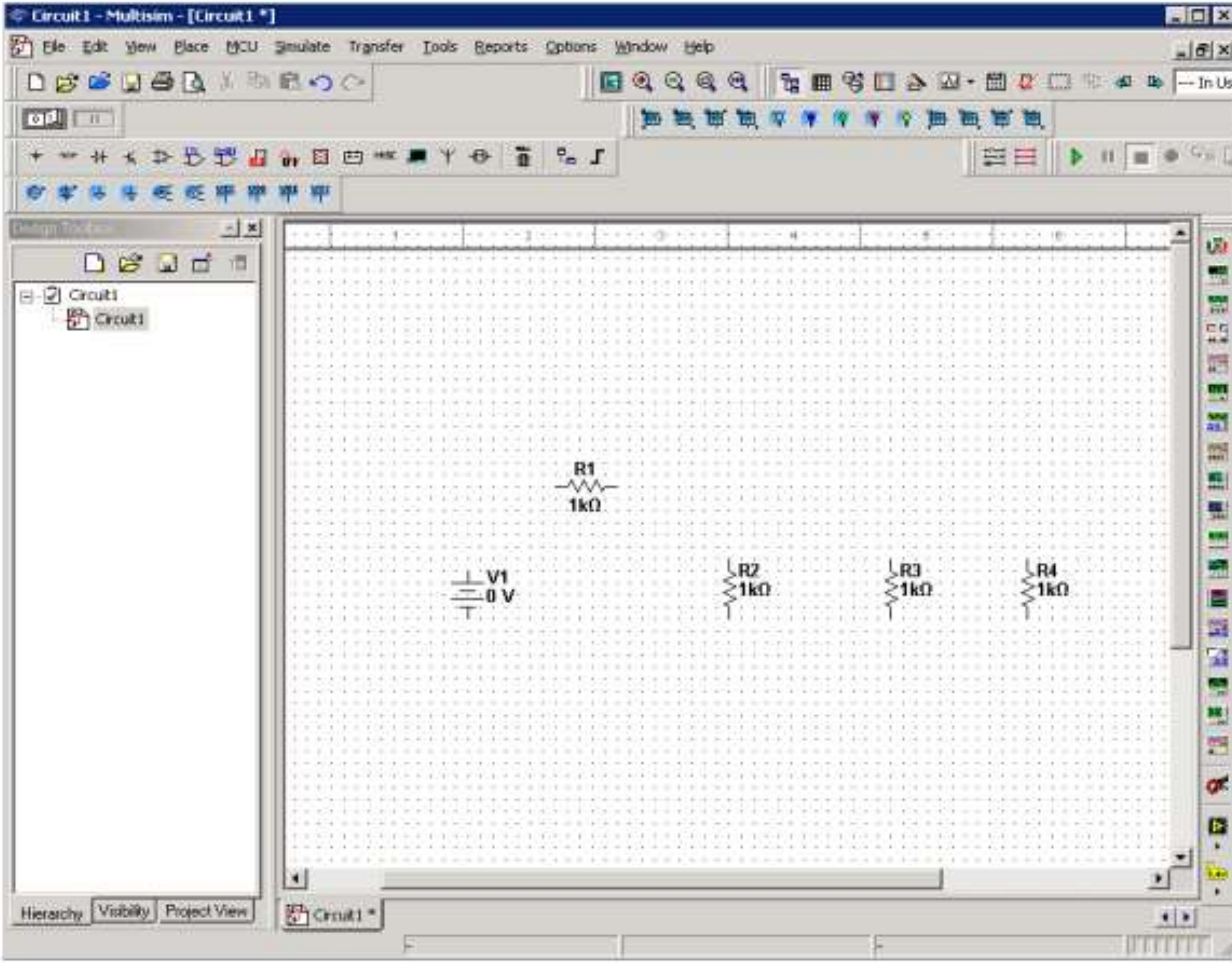


Figure 2: Select DC voltage

For example to select resistors and the DC source shown in Figure 3 click on **Place/ Components**. In **Group** select **Basic** scroll down to Resistors and select the value of the resistor needed to construct the circuit, for this example select 1k. To place DC source click on Sources in **Group** and select DC Source. As shown in Figure 1 and Figure 2 respectively.


Circuit1 - Multisim - [Circuit1 *]
File Edit View Place MCU Simulate Transfer Tools Reports Options Window Help
Circuit1
Circuit1
R1
1kΩ
V1
0 V
R2
1kΩ
R3
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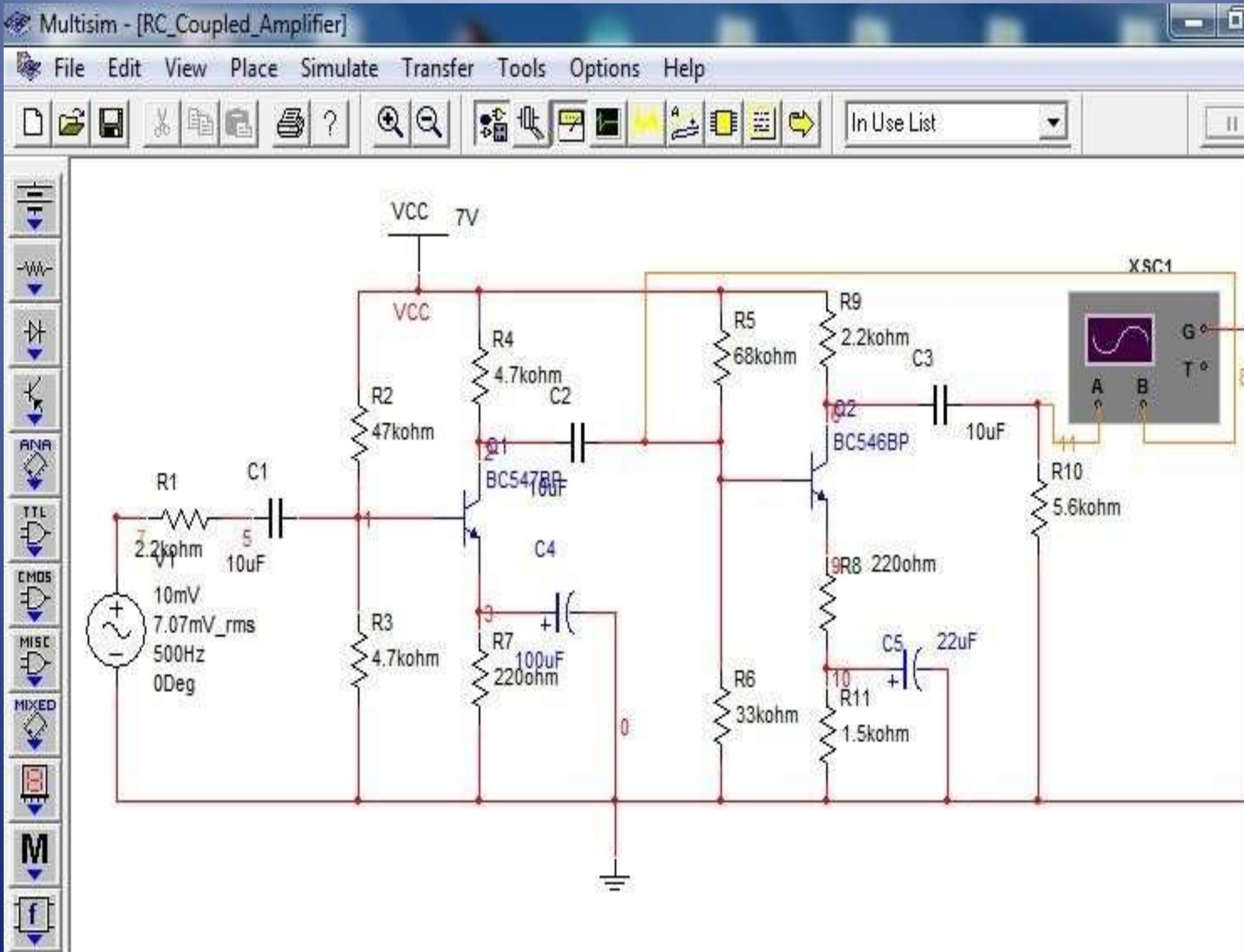
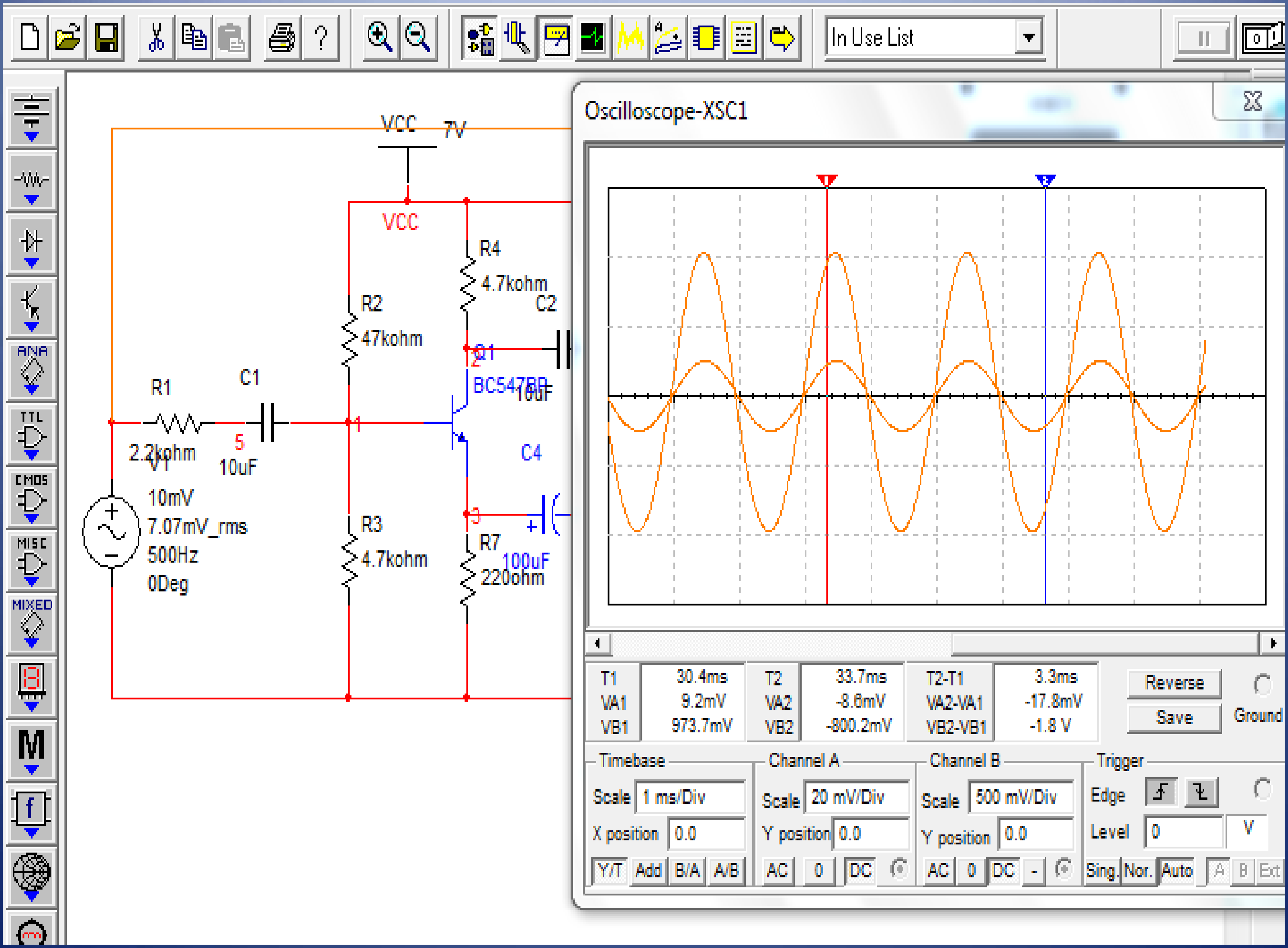
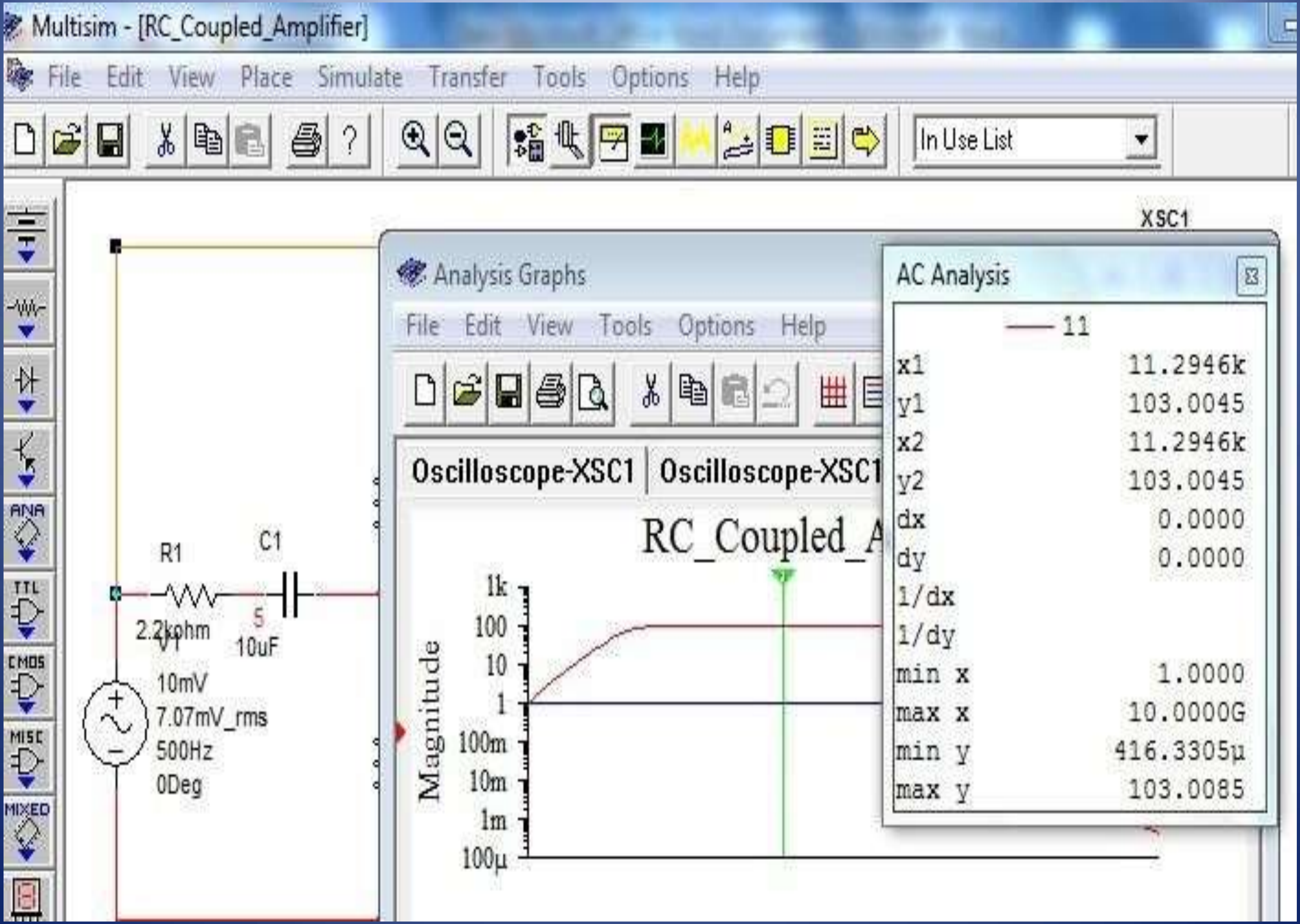


Multisim - [RC_Coupled_Amplifier]
File Edit View Place Simulate Transfer Tools Options Help
In Use List
VCC 7V
VCC
R4 4.7kohm
R2 47kohm
C2
Q1
BC547BP
10uF
R1 2.2kohm
C1 10uF
V1 10mV 7.07mV_rms 500Hz 0Deg
C4
R3 4.7kohm
R7 220ohm
100uF
R5 68kohm
R9 2.2kohm
C3 10uF
Q2
BC546BP
R8 220ohm
C5 22uF
R6 33kohm
R11 1.5kohm
R10 5.6kohm
XSC1
G
T
A
B



In Use List
VCC 7V
VCC
R4
4.7kohm
C2
R2
47kohm
Q1
BC547BP
10uF
R1
C1
2.2kohm
V1
10uF
10mV
7.07mV_rms
500Hz
0Deg
C4
R3
4.7kohm
R7
100uF
220ohm
Oscilloscope-XSC1
T1 30.4ms
VA1 9.2mV
VB1 973.7mV
T2 33.7ms
VA2 -8.6mV
VB2 -800.2mV
T2-T1 3.3ms
VA2-VA1 -17.8mV
VB2-VB1 -1.8 V
Reverse
Save
Ground
Timebase
Scale 1 ms/Div
X position 0.0
Y/T Add B/A A/B
Channel A
Scale 20 mV/Div
Y position 0.0
AC 0 DC
Channel B
Scale 500 mV/Div
Y position 0.0
AC 0 DC -
Trigger
Edge
Level 0 V
Sing. Nor. Auto
A B Ext



Multisim - [RC_Coupled_Amplifier]
File Edit View Place Simulate Transfer Tools Options Help
In Use List
XSC1
R1
C1
2.2kohm
5
10uF
V1
10mV
7.07mV_rms
500Hz
0Deg
Analysis Graphs
File Edit View Tools Options Help
Oscilloscope-XSC1
Oscilloscope-XSC1
RC_Coupled_A
Magnitude
1k
100
10
1
100m
10m
1m
100µ
AC Analysis
11
x1 11.2946k
y1 103.0045
x2 11.2946k
y2 103.0045
dx 0.0000
dy 0.0000
1/dx
1/dy
min x 1.0000
max x 10.0000G
min y 416.3305µ
max y 103.0085

Major Equipment Details

S.No	Name of the Equipment	Quantity		Amount (Rs.)
1.	Regulated Power Supply Digital-Dual (0-30V)	14		63,600/-
2.	Function Generators (1 MHz)	10	14	60,960/-
	Function Generators (2 MHz)	04		
3.	Multimeters (Digital)	10		13,500/-
4.	Cathode Ray Oscilloscopes (20 MHz)	10		1,38,000/-
5.	Decade Resistance Box (DRBs)	06		7,200/-
6.	Decade Inductance Box (DIBs)	06		9,600/-
7.	Decade Resistance Box (DCBs)	06		9,000/-
8.	LCR Meter	01		5,800/-
9.	Stabilizer (5 KVA)	01		9,500/-
10.	DC Voltmeters - (Digital)	15		15,500/-
11.	DC Ammeters - (Digital)	15		15,000/-
12.	Bread Board Trainer Kits	05		18,000/-
13.	Electronic Circuits Analysis (ECA) Kits	13		21,817/-
		Total		**3,87,477/-**

(Rupees Three Lakh Eighty Seven Thousand Four Hundred and Seventy Seven only)

Lab Physical View

Do’s & Don'ts

- While entering the Laboratory, the students should follow the dress code (Wear shoes, White Apron & Female students should tie their hair back).
- The students should bring their observation note book, practical manual, record note book, calculator, necessary stationary items and graph sheets if any for the lab classes without which the students will not be allowed for doing the practical.
- All the equipments and components should be handled with utmost care. Any breakage/damage will be charged.
- If any damage/breakage is noticed, it should be reported to the instructor immediately.
- If a student notices any short circuits, improper wiring and unusual smells immediately the same thing is to be brought to the notice of technician/lab in charge.
- At the end of practical class the apparatus should be returned to the lab technician and take back the indent slip.
- Each experiment after completion should be written in the observation note book and should be corrected by the lab in charge on the same day of the practical class.
- Each experiment should be written in the record note book only after getting signature from the lab in charge in the observation note book.
- Record should be submitted in the successive lab session after completion of the experiment.
- 100% attendance should be maintained for the practical classes.

	
Fire Extinguishers	First Aid Box
	
Miniature Circuit Breaker's (MCB's).	CC Camera surveillance

Table 6.4.2 Safety Measures in the Laboratories

THANK YOU