SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur-603203

DEPARTMENT OF

ELECTRONICS AND INSTRUMENTATION ENGINEERING

GE3134 Engineering Practices Laboratory Manual

I SEMESTER B.E/B.TECH

(Common to all branches)

2023-2024 ODD SEMESTER

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LABORATORY PRACTICE

SAFETY RULES

1. SAFETY is of paramount importance in the Laboratories.
2. Electricity NEVER EXECUSES careless persons. So, exercise enough care and attention in handling electrical & electronic equipment and follow safety practices in the laboratory. (Electricity is a good servant but a bad master).
3. Avoid direct contact with any voltage source and power line voltages. (Otherwise, any such contact may subject you to electrical shock).
4. Wear rubber-soled shoes. (To insulate you from earth so that even if you accidentally contact a live point, current will not flow through your body to earth and hence you will be protected from electrical shock).
5. Wear laboratory-coat and avoid loose clothing. (Loose clothing may get caught on an equipment/instrument and this may lead to an accident particularly if the equipment happens to be a rotating machine).
6. Girl students should have their hair tucked under their coat or have it in a knot.
7. Do not wear any metallic rings, bangles, bracelets, wristwatches and neck chains. (When you move your hand/body, such conducting items may create a short circuit or may touch a live point and thereby subject you to electrical shock).
8. Be certain that your hands are dry and that you are not standing on wet floor. (Wet parts of the body reduce the contact resistance thereby increasing the severity of the shock).
9. Ensure that the power is OFF before you start connecting up the circuit. (Otherwise you will be touching the live parts in the circuit).
10. Get your circuit diagram approved by the staff member and connect up the circuit strictly as per the approved circuit diagram.
11. Check power chords for any sign of damage and be certain that the chords use safety plugs and do not defeat the safety feature of these plugs by using ungrounded plugs.
12. When using connection leads, check for any insulation damage in the leads and avoid such defective leads.
13. Switch on the power to your circuit and equipment, only after getting them checked up and approved by the staff member.
14. Do not make any change in the connection without the approval of the staff member.
15. In case you notice any abnormal condition in your circuit (like insulation heating up, resistor heating up etc.), switch off the power to your circuit immediately and inform the staff member.
16. Keep hot soldering iron in the holder when not in use.
17. After completing the experiment show your readings to the staff member and switch off the power to your circuit after getting approval from the staff member.

SYLLABUS

GE 3138 ENGINEERING PRACTICES LABORATORY **L T P C**

(Common to all branches of B.E. / B.Tech. Programmes) **0 0 4 2**

COURSE OBJECTIVES:

(i) To provide hands on training for fabrication of components using carpentry, sheet metal and welding equipment / tools.

(ii) To gain the skills for making fitting joints and assembling air conditioner.

(iii) To develop the skills for making simple electrical wiring connections using suitable tools.

(iv) Develop soldering in simple PCB board.

(v) To gain knowledge about the behavior of electronics components.

GROUP B (ELECTRICAL & ELECTRONICS)

ELECTRONICS ENGINEERING PRACTICE

1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, RMS period, frequency) using CRO.
2. Study of logic gates AND, OR, EX-OR and NOT.
3. Generation of Clock Signal.
4. Soldering practice – Components, Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

TOTAL: 15 PERIODS
(For Electronics)

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

(i) Fabricate carpentry components and pipe connections including plumbing works.

(ii) Illustrate on centrifugal pump, Air conditioner, operations of smithy, foundary and fittings

(iii) Carry out basic home electrical works and appliances

(iv) Elaborate on the components, gates, soldering practices.

(v) Measure the electrical quantities

List of Experiments

Group B (Electrical & Electronics)

ELECTRONICS ENGINEERING PRACTICE

Exp. No.	Experiments
1(a)	Study of Electronic components and equipments
1(b)	Study of Resistor colour coding
1(c)	Measurement of AC signal parameters (peak-peak, rms, Time period, frequency) using CRO and Multimeter.
2.	Study of logic gates AND, OR, EX -OR and NOT
3.	Generation of Clock Signal.
4.	Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5(a)	Measurement of ripple factor of Half Wave Rectifier
5(b)	Measurement of ripple factor of Full Wave Rectifier

Exp No: 1(a)

STUDY OF ELECTRONIC COMPONENTS AND EQUIPMENTS

AIM

To study about the Electronic Components and Equipments such as Active and different types of Passive components are Resistors, Capacitors and Inductors.

TYPES OF ELECTRONIC COMPONENTS ACTIVE COMPONENT

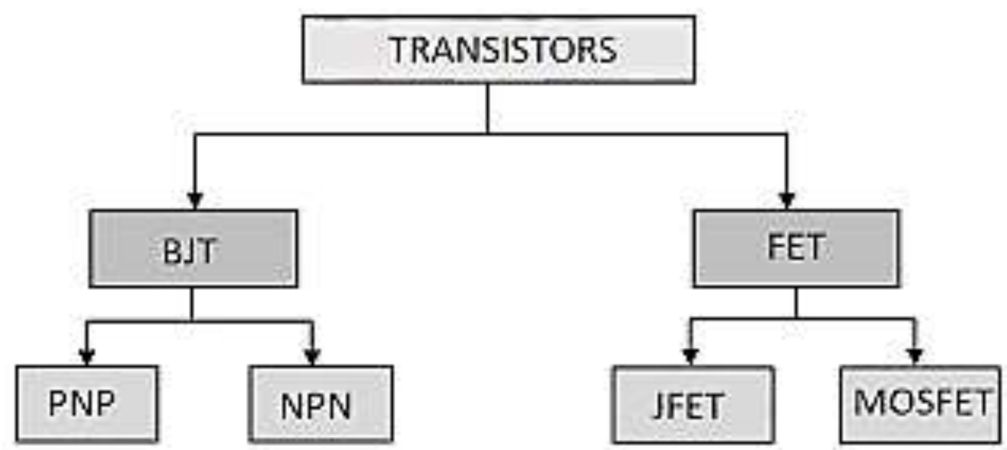
Sl.No	Active Components	Passive Components
1	Transistors	Resistor
2	Op-Amps	Capacitor
3	Diodes	Inductor

TRANSISTORS

A transistor is a semiconductor device used to amplify and switch electronic signals and electrical power. It is composed of semiconductor material with at least three terminals for connection to an external circuit. A voltage or current applied to one pair of the transistor's terminals changes the current flowing through another pair of terminals.

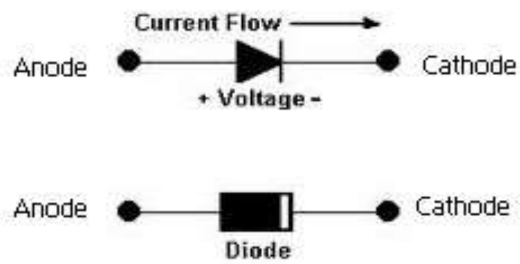
TYPES OF TRANSISTORS

1. Bipolar Junction Transistor
2. Field Effect Transistor



DIODES:

Current passes more easily in one direction (from anode to cathode) than in the reverse direction. Diodes have many uses, including conversion of AC power to DC power, and the decoding of audio-frequency signals from radio signals.



TYPES OF DIODES

1. PN Junction Diode
2. PIN Diode
3. Zener Diode
4. Tunnel Diode

PASSIVE COMPONENTS

Definition:

A passive component is a module that does not require energy to operate, except for the available Alternating Current (AC) circuit that it is connected to. A passive module is not capable of power gain and is not a source of energy. A typical passive component would be a chassis, inductor, resistor, transformer, or capacitor.

PASSIVE COMPONENTS

RESISTORS

Resistors are the most common components in electronic circuits. Its main function is to reduce the high current to the desired value and also to provide desired voltage in the circuit. The resistors are manufactured to have a specific value in ohm. The physical size of resistor determines how much power can be dissipated in the form of heat. However there is co-relation between resistor physical sizes and its resistance value. They are manufactured in variety of standard values and power settings.

There are two types of resistors:

- Fixed resistor
- Variable resistor

Fixed resistor has a resistance value that does not change where as a variable resistor having variable resistance range with 4 lines or color code. They indicate the resistance value in ohms out on a larger resistor; the resistance value is printed on the body of the resistor.

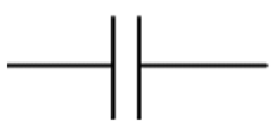
The important feature of resistor is that its effect is same for both AC and DC circuits.

TYPES OF RESISTORS

- Wire wand resistors
- Carbon Composition resistors
- Film resistors
- Surface mount resistors
- Fusible resistors

CAPACITOR

A capacitor is a passive two terminal component which stores electric charge. This component consists of two conductors which are separated by a dielectric medium. The potential difference when applied across the conductors polarizes the dipole ions to store the charge in the dielectric medium. The unit of capacitance is Farad and it is denoted as F. The circuit symbol of a capacitor is shown below:



Symbolic representation Disc capacitor Polarity representation

TYPES OF CAPACITORS

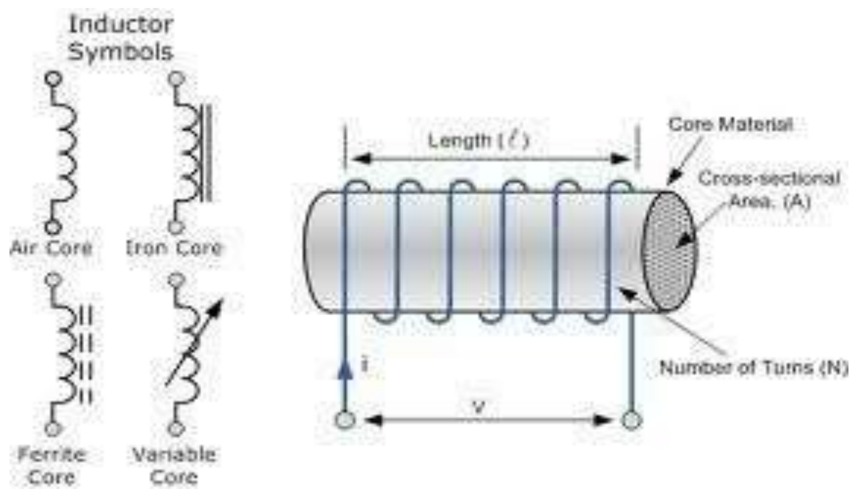
- Ceramic capacitor
- Electrolytic capacitor
- Tantalum capacitor
- Silver Mica Capacitor
- Polystyrene Film Capacitor
- Polyester Film Capacitor
- Metalized Polyester Film Capacitor Polycarbonate capacitor
- Polypropylene Capacitor
- Glass Capacitor

INDUCTOR

An inductor (also choke, coil or reactor) is a passive two-terminal electrical component that stores energy in its magnetic field. For comparison, a capacitor stores energy in an electric field, and a resistor does not store energy but rather dissipates energy as heat. The unit of inductance is Henry and it is denoted as H.

TYPES OF INDUCTORS

- Air core inductor
- Radio frequency inductor
- Ferromagnetic core inductor
- Laminated core inductor
- Ferrite-core inductor
- Toroidal core inductor
- Variable inductor



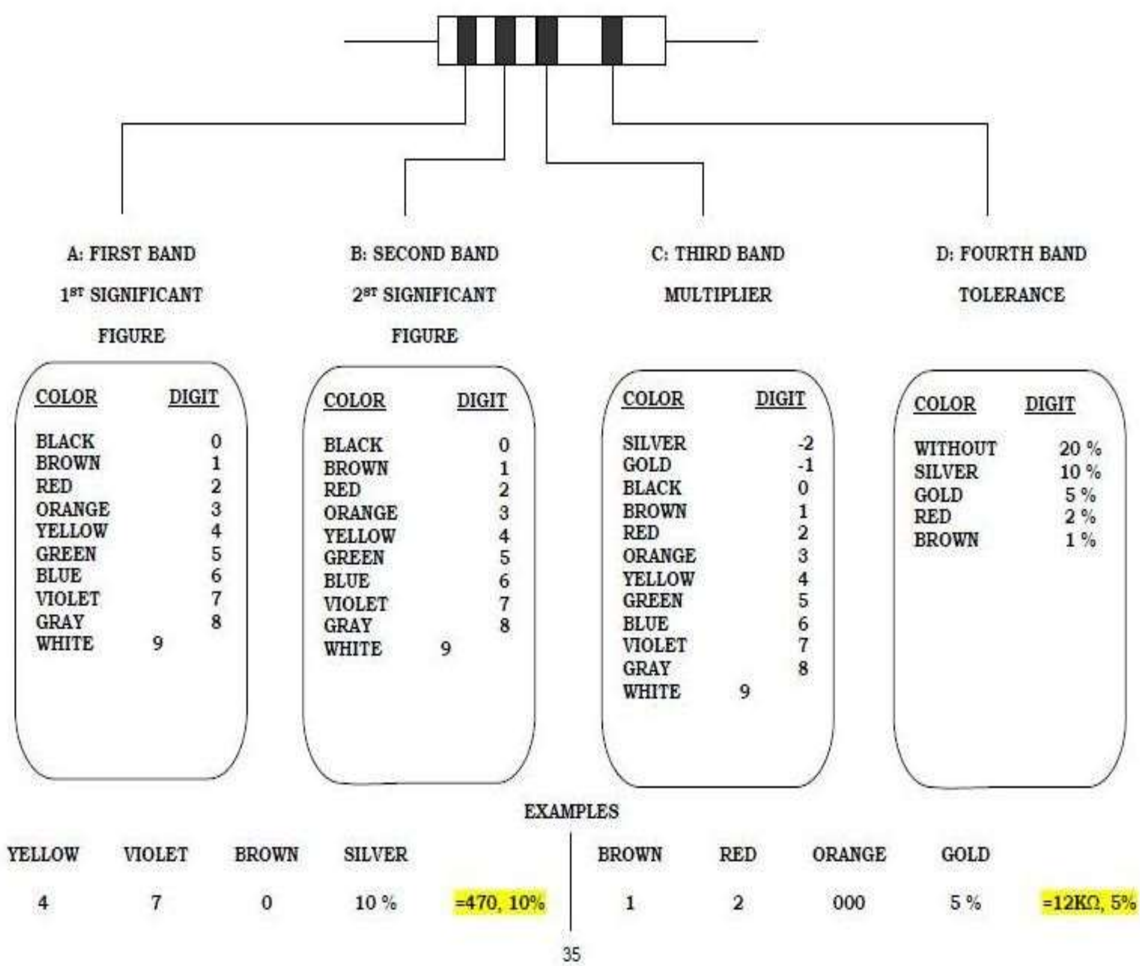
<u>Design and Symbolic representation</u>

Result:

Thus the above study experiment electronic components and equipments was studied clearly.

Tabulation:

Resistor	**1st significant figure**	**2nd significant figure**	**Multiplier**	**Tolerance**	**Measured Resistor Value** by Colour Coding (in Ohms)	**Actual Resistor Value** using Multimeter (in Ohms)
R1						
R2						
R3						



Exp No : 1(b)

STUDY OF RESISTOR COLOUR CODING

Aim:

To find the value of given resistors using colour coding chart.

Apparatus Required:

1. Resistors-various ranges

Theory:

Resistors have three principal ratings: resistance in ohms, tolerance in percent, and power dissipation in watts. Most of the resistors we have in the lab can dissipate ¼ watt and have tolerances of +or - 5 %.Resistance values are coded on the resistors with color bands. The first two bands give two significant digits of the value, the third band is a multiplier expressed as a power of 10, and the fourth band is the tolerance. The table below shows the color code. For example, red-red orange-gold is 22 KΩ + or - 5 %. Sometimes ¼ watt is not enough for a circuit application and then a physically larger resistor is required.

PROCEDURE:

1. Find the nominal value and the tolerance of each resistance using the color codes
2. Calculate the resistor values and using the digital Multimeter as an ohmmeter, we can cross check and record the resistance of each.

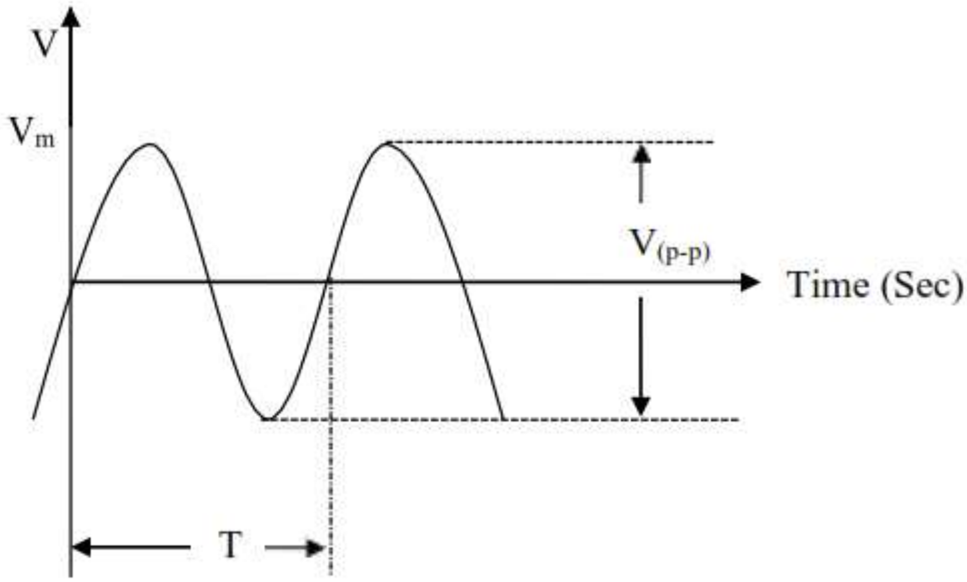
Result:

Thus the value of the resistors is obtained by using the colour coding technique.

VIVA QUESTIONS:

1. What is a resistor?
2. What is the function of a resistor?
3. How will you find out the resistor value?
4. What is tolerance?

AC Sine Waveform



Tabular Column:

Peak to Peak voltage $V_{(p-p)}$ (Volts)	**Maximum Voltage V_m (Volts)**	**RMS voltage V_{RMS} (Volts)**	**Time Period T (sec)**	**Frequency f (Hz)**

Exp No: 1(c)

MEASUREMENT OF AC SIGNAL PARAMETER (PEAK-PEAK, RMS TIME PERIOD AND FREQUENCY) USING CRO

Aim:

To study the electronic components and equipments including the resistor and color coding and to measure the various AC signal parameters (Peak-peak, RMS, Time Period and frequency) using CRO

Apparatus Required:

1. CRO
2. Function generator

Formula used:

1. Peak to peak voltage $V_{(p-p)}$ = No. of divisions X Volts/Divisions
2. Maximum Voltage $V_m = V_{(p-p)} / 2$ (V)
3. Root Mean Square Voltage $V_{RMS} = V_m / \sqrt{2}$ (V)
4. Time period (T) = No. of divisions X Time/Divisions (Sec)
5. Frequency (f) = 1/T (Hz)

Theory:

A sinusoidal signal is a general sine function. An electrical signal is a voltage or current which conveys information, usually it means a voltage. The term can be used for any voltage or current in a circuit. The voltage-time graph above shows the various properties of an electrical signal. In addition to the properties labelled on the graph, there is frequency which is the number of cycles per second. The diagram shows a sine wave but these properties apply to any signal with a constant shape.

Procedure:

1. AC signal is given as an input to CRO.
2. The CRO display is noted.
3. From the display the various parameters like peak-peak voltage, maximum voltage and time period are noted.
4. By using the formulas, the RMS value and frequency are calculated.

Result:

Thus the various AC signal parameters (Peak-peak, RMS, Period and frequency) were measured using CRO.

VIVA QUESTIONS:

1. What is meant by AC supply?
2. What is peak to peak voltage?
3. What is rms voltage?
4. What is maximum voltage?
5. What is Frequency?
6. How is the time period measured?

Exp No : 2

STUDY OF LOGIC GATES

AIM

The purpose of this experiment is to get familiar with the elementary Logic gates and to know the use of them for implementing logic circuits.

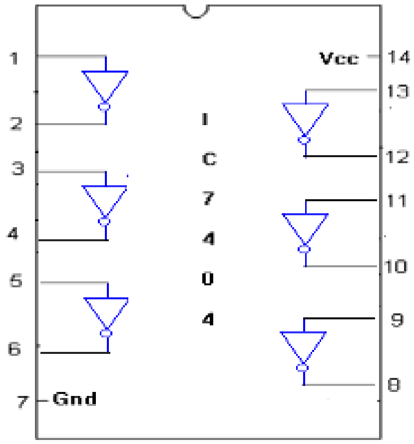
COMPONENTS REQUIRED

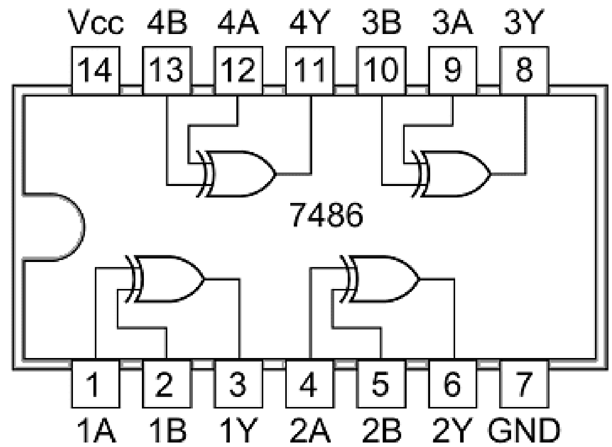
S. No.	COMPONENTS	SPECIFICATION	QTY
1.	AND GATE	IC 7408	1
2.	OR GATE	IC 7432	1
3.	NOT GATE	IC 7404	1
4.	XOR GATE	IC 7402	1
5.	IC TRAINER KIT	-	1
6.	PATCH CORD	-	14

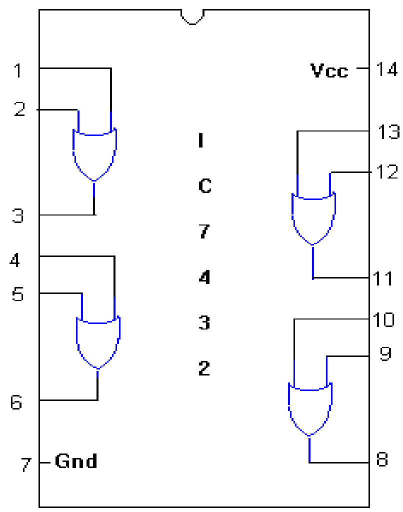
THEORY

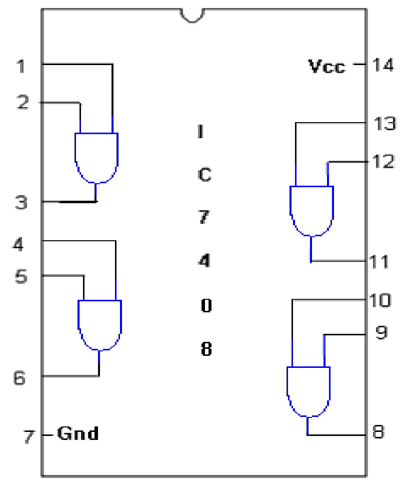
Digital electronics is found in everything from computers to CD players and watches. It is based on the binary number system. Instead of voltages which vary continuously, as in analog electronics, digital circuits involve voltages which take one of only two possible values. In our case these are 0 and 5 volts (TTL logic), but they are often referred to as LOW and HIGH, or FALSE and TRUE, or as the binary digits 0 and 1.The basic building blocks of digital electronics are logic gates which perform simple binary logic functions (AND, OR, NOT, etc.). From these devices, one can construct more complex circuits to do arithmetic, act as memory elements, and so on. In this lab, you will look at a few basic devices to see what they can do. Logic gates and other digital components come in the form of integrated circuits (ICs) which consist of small semiconductor \chips packaged in a ceramic or plastic case with many pins. The ICs are labeled by numbers like 74LSxx, where xx is a number identifying the type of device.

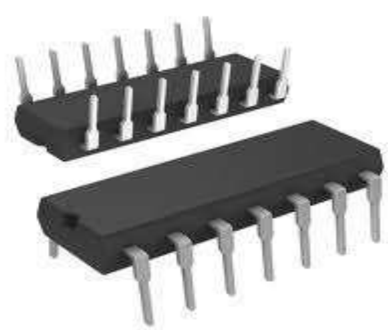
PIN DIAGRAM of IC`s











Picture Representation of an IC

LOGIC GATES

NOT GATE (IC 7404)

In digital logic, an inverter or NOT gate is a logic gate which implements logical negation. The 7404 chip contains six inverters. An inverter simply converts binary 1 to 0 and vice versa.

AND GATE (IC 7408)

The AND gate is a digital logic gate that implements logical conjunction - it behaves according to the truth table to the right. A HIGH output (1) results only if both the inputs to the AND gate are HIGH (1). If neither or only one input to the AND gate is HIGH, a LOW output results. In another sense, the function of AND effectively finds the minimum between two binary digits, just as the OR function finds the maximum.

OR GATE (IC 7432)

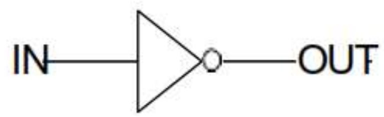
The OR gate is a digital logic gate that implements logical disjunction - it behaves according to the truth table to the right. A HIGH output (1) results if one or both the inputs to the gate are HIGH (1). If neither input is HIGH, a LOW output (0) results. In another sense, the function of OR effectively finds the maximum between two binary digits, just as the complementary AND function finds the minimum.

Exclusive OR Gate – EXOR Gate (IC 7486)

The **EXOR gate** is used extensively in digital data processing circuits and is known as **Exclusive-OR-gate.** The EXOR gate has a high output only when an odd number of inputs are high. For the two input EXOR gates, the output will be high when the set of input is either 01 or 10. The XOR gate is used in the adder, subtractor and controlled inverter circuit. It is also used in the computers for implementing the binary addition.

Result:
Thus the basic logic gates were studied and its truth table are tabulated.

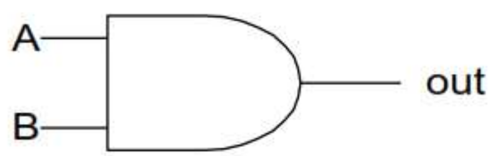
NOT gate (7404)



TRUTH TABLE

IN	OUT
1	
0	

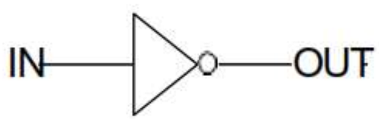
AND gate (7408)



TRUTH TABLE

A	B	OUT
0	0	
0	1	
1	0	
1	1	

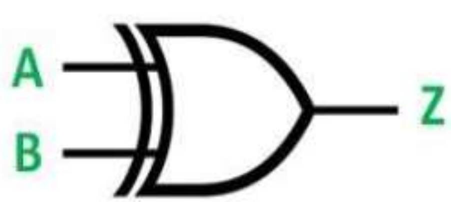
NOT gate (7404)



TRUTH TABLE

IN	OUT
1	
0	

Exclusive OR Gate – EXOR Gate (IC 7486)



TRUTH TABLE

A	B	OUT
0	0	
0	1	
1	0	
1	1	

VIVA QUESTIONS

1. What are the universal gates
2. Draw the truth table of AND gate.
3. Draw the truth table of NOT gate.
4. Draw the truth table of OR gate.
5. How many gates will be there in a IC 7404 chip?
6. What gate does the IC 7408 consist of?
7. What are the 7^{th} and 14^{th} pin in all the gates?

Exp No : 3

GENERATION OF CLOCK SIGNAL

Aim:

To generate a clock signal in Astable Multivibrator using 555 timer.

Apparatus Required:

S.No	Equipment Required	Quantity	Type/Range
1	555 Timer IC	1	555 Timer
2	Resistance	1	6.8KΩ,3.3KΩ
3	Capacitors	1	0.01µF,0.101µF
4	CRO	1	0-30MHz
5	RPS (0-30)V	1	0-30V
6	Bread board	1	
7	Connecting wires		

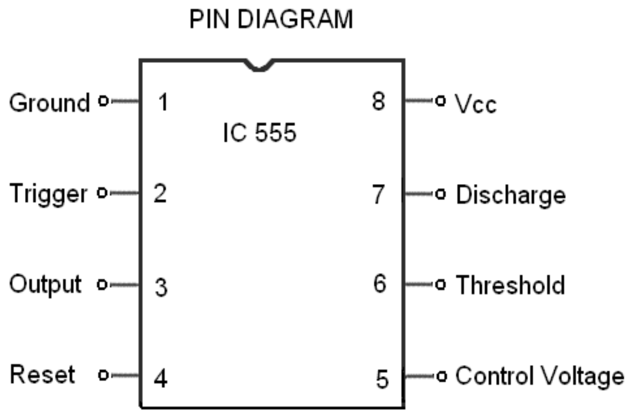
Theory:

Timing resistor is split into R_a and R_b. Pin 7 is connected to the junction of R_a and R_b along with power supply V_{cc}. External timing capacitor C charges towards Vcc with time constant $(R_a + R_b)C$. During this time, the output at the pin 3 is high.

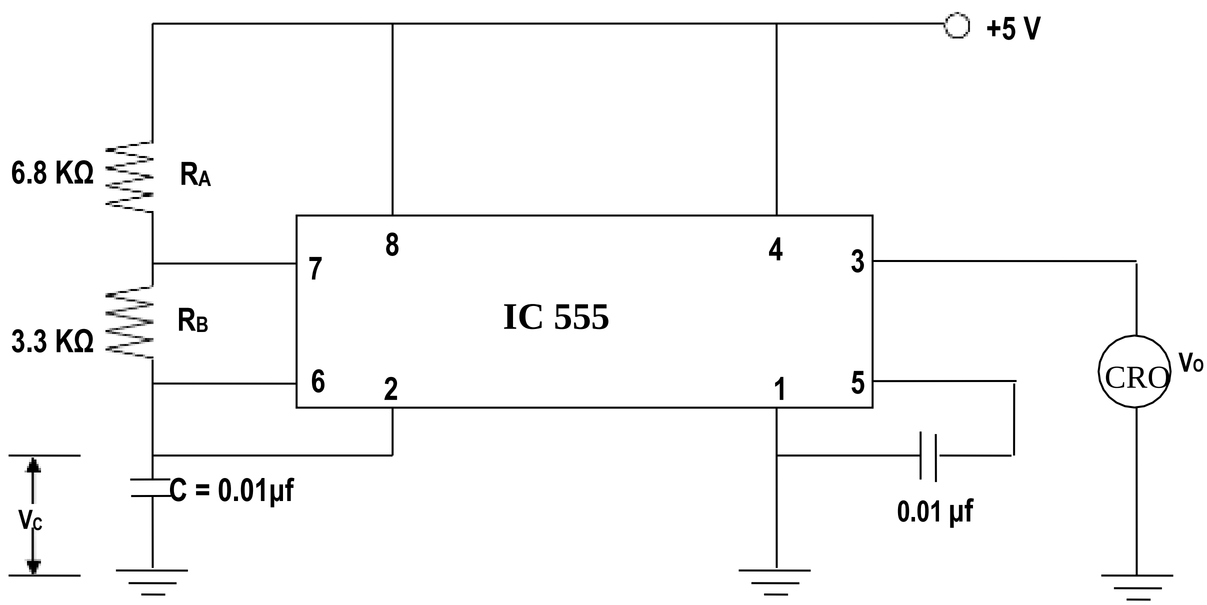
When the capacitor voltage equals to 2/3 V_{cc}, the upper comparator trigger the control flip-flop.

Formula used:

1. $T_{on} = 0.69\ ((R_a + R_b)C$
2. $T_{off} = 0.69\ R_bC$
3. $T\ = T_{on} + T_{off}$



Circuit Diagram



Tabulation:

Sl.No.	Output Voltage, V_o (Volts)	ON time T_{on} (Sec)	OFF time T_{off} (Sec)	Total time $T_{on} + T_{off}$ (Sec)	Frequency f= 1/T (Hz)

Procedure:

1. Connections are made as per the circuit diagram.
2. +5 Volts is given to the Vcc terminal.
3. t_{on} , t_{off} values are calculated from the given formula.
4. The graph is drawn.

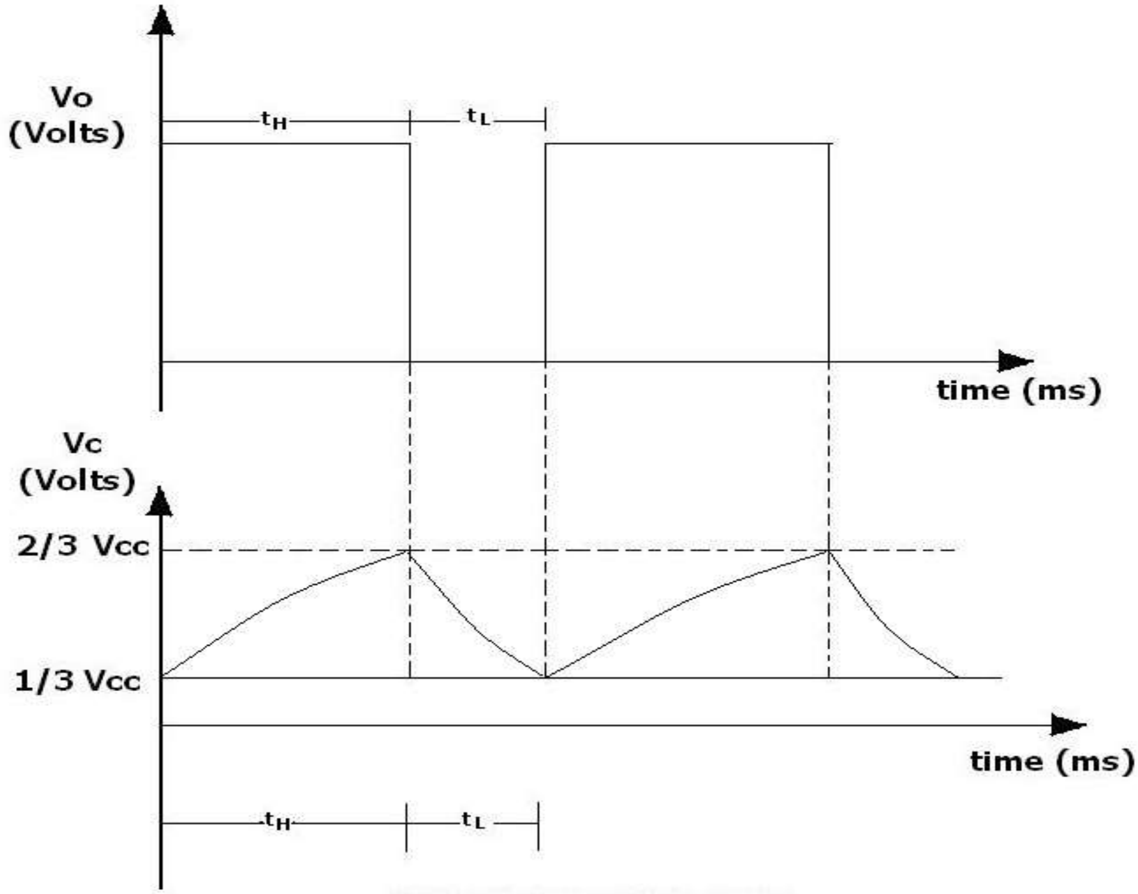
Result:

Thus a clock signal was generated using 555 timer IC for different values of resistances.

Viva Questions

1. What is a clock signal?
2. What are the applications of Clock signal?
3. What is the purpose of CRO?
4. Can we generate clock signal without using 555 timer?
5. What is the use of triggering signal , Threshold and control voltage?

WAVEFORM



CAPACITOR WAVEFORM

Exp No : 4

SOLDERING PRACTICE COMPONENTS DEVICES AND CIRCUITS USING GENERAL PURPOSE PCB

Aim:

To practice soldering and desoldering for the electronic circuit by assembling and

Apparatus Required:

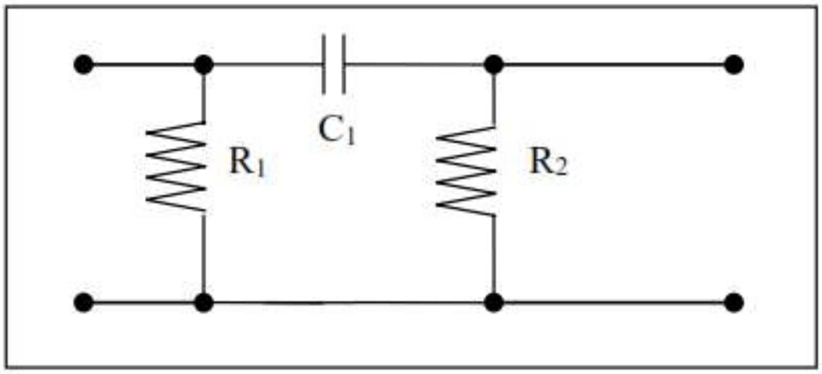
S.No	Component	Range	Quantity
1	PCB board for given circuit	10w(or)35w	1
2	Soldering iron	60/40 grade	1
3	Solder		1
4	Flux		1
5	Electrician's Knife		1
6	Nose plier		1
7	Resistors	10kΩ	4
8	Capacitor	0.01μF	2

Procedure:

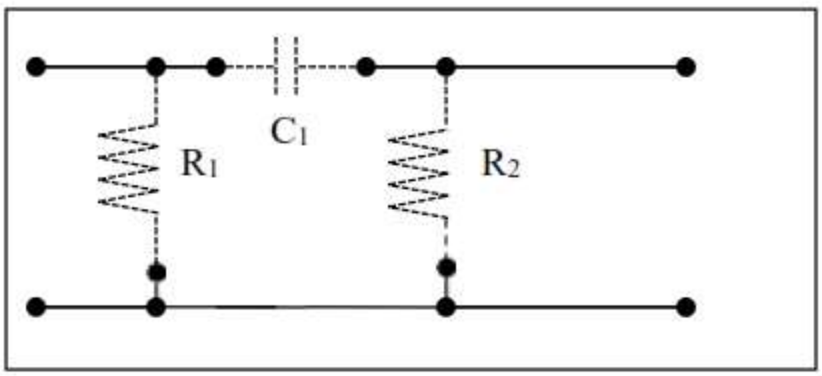
Soldering

1. The given electronic circuit is studied.
2. The PCB board is cleaned.
3. The tip of the soldering iron is cleaned before heating and also the resistors and capacitor which is to be soldered is cleaned.
4. The soldering iron is heated and the solder is applied to the tip of it.
5. The resistor (R) leads are bent to fit the holes on the board and they are inserted in the holes of the board as per the circuit diagram.
6. The hot tip is applied to the joints and the solder is applied.
7. The soldering tip is removed and the resistor is hold tightly till the solder is cooled and set.
8. The excess component lead is trimmed with side cutter.
9. The above steps are repeated to fix the other resistor and capacitor in the circuit

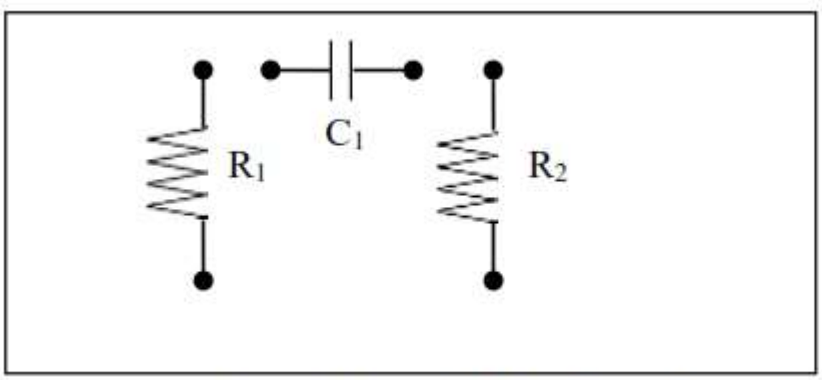
Given circuit



Drawing



Back side of the PCB board

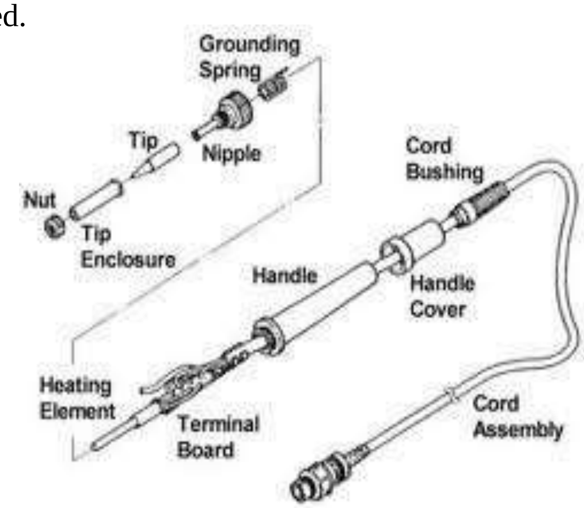


Front side of the PCB board

De-Soldering

1. The tip of the soldering iron is placed on the resistor- board joint until the solder is melt.
2. When the solder is melted the resistor is removed with a tweezers and the molten solder is removed.
3. The above steps are repeated to remove the other resistor and capacitor.
4. The resistors and capacitors are cleaned.

Soldering way



Solder gun

Result:

Thus the soldering and de-soldering practice is done for the given electronic circuit.

VIVA QUESTIONS

1. What is a Resistor?

2. What is a capacitor?

3. What is Soldering and De-Soldering?

4. What is a PCB? State the use of PCB?

5. What are the uses of soldering and de-soldering?

Exp No: 5(a)

MEASUREMENT OF RIPPLE FACTOR FOR HALF WAVE RECTIFIERS

AIM:

To study the ripple factor of a half wave rectifier.

EQUIPMENTS REQUIRED:

SL.NO.	NAME OF THE EQUIPMENT	RANGE	QUANTITY
1.	Transformer	12v-0v-12v	1
2.	Capacitor	0.1 µF	2
3.	Resistor	470Ω	1
4.	PN junction diode	IN 4007	2
5.	Bread Board	-	1
6.	CRO	-	1

FORMULAE USED:

Ripple Factor, $\gamma = \sqrt{(Vrms / Vdc)^2 - 1}$

Where, V_{rms} = The rms value of the a.c component of the output voltage

V_{dc} = The average or d.c value of the output voltage.

HALF WAVE RECTIFIER:

$Vdc = Vm/\pi$

$Vrms = Vm/2$

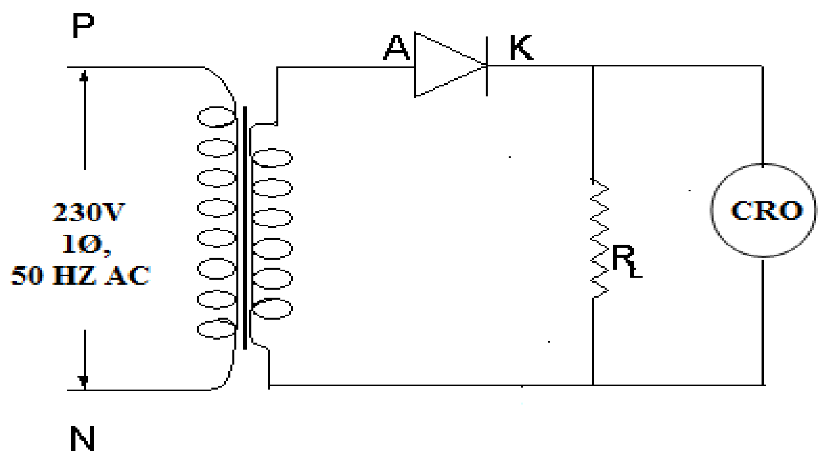
Theory: A rectifier is defined as a electronic device used for converting AC voltage into unidirectional voltage. A rectifier utilizes unidirectional conduction devices like Vacuum diode or PN junction diode.

Half wave rectifier:

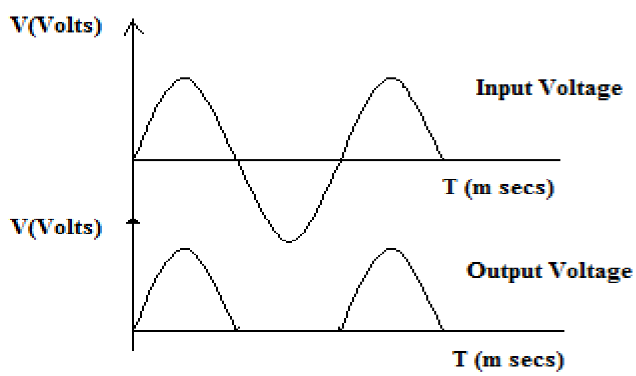
It converts an ac voltage into a pulsating DC voltage using only one half of the applied ac voltage. The rectifying diode conducts during one half of the ac cycle. During

CIRCUIT DIAGRAM

Half Wave Rectifier



MODEL GRAPH:



TABULATION:

Voltage	Peak to Peak voltage $V_{(p-p)}$ (Volts)	Maximum Voltage V_m (Volts)	Time Period (sec)	Ripple factor
Input				
Outpu				

positive half cycle of the input signal the anode of diode becomes positive with respect to cathode and hence the diode conducts. For an ideal diode the forward voltage drop is zero so the whole input voltage appears across the load. During negative half of the input signal the anode of the diode becomes negative with respect to cathode and hence the diode does not conduct. For an ideal diode the impedance offered by the diode is unity so the whole input voltage drop across diode. Hence voltage drop across R_L is zero.

PROCEDURE:

1. Connect the circuit as per the circuit diagram.
2. Connect the CRO across the load.
3. from the waveform in the CRO screen, note down the amplitude and frequency along with multiplication factor.
4. Calculate the ripple factor.

RESULT:

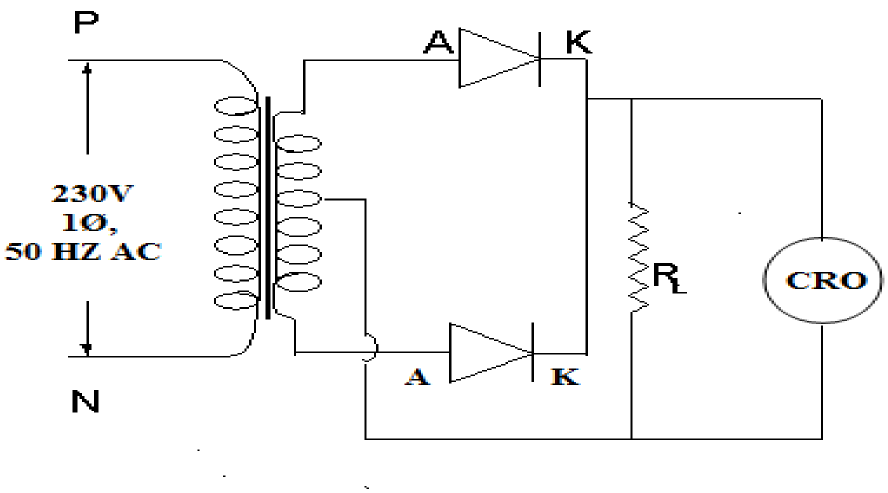
Thus the input & output waveforms are drawn for half wave rectifiers and ripple factor calculated.

VIVA QUESTIONS:

1. Define Rectifier?
2. What is Half-Wave Rectifier?
3. Define Ripple Factor?
4. What type of output we get from HWRectifier?
5. What is the value of Ripple factor for HW Rectifier?
6. What is the formulae for Vrms for HW Rectifier?
7. What is the formulae for Vdc for HW Rectifier?

CIRCUIT DIAGRAM

FULL WAVE RECTIFIER



Exp No: 5(b)

MEASUREMENT OF RIPPLE FACTOR FOR FULL WAVE RECTIFIERS

AIM:

To study the ripple factor and regulation characteristics of a full wave rectifier.

EQUIPMENTS REQUIRED:

SL.NO.	NAME OF THE EQUIPMENT	RANGE	QUANTITY
1.	Transformer	12v-0v-12v	1
2.	Capacitor	0.1 µF	2
3.	Resistor	470Ω	1
4.	PN junction diode	IN 4007	2
5.	Bread Board	-	1
6.	CRO	-	1

FORMULA USED:

Ripple Factor, $\gamma = \sqrt{(V_{rms} / V_{dc})^2 - 1}$

Where, V_{rms} = The rms value of the a.c component of the output voltage

V_{dc} = The average or d.c value of the output voltage.

FULL WAVE RECTIFIER:

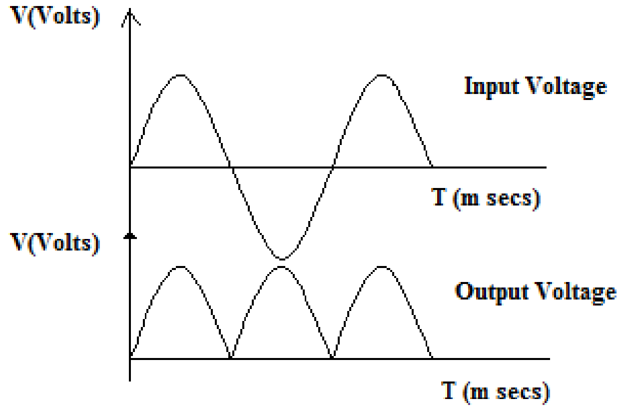
$$V_{dc} = 2 V_m/\pi$$

$$V_{rms} = V_m/\sqrt{2}$$

Theory:

A rectifier is defined as a electronic device used for converting AC voltage into unidirectional voltage. A rectifier utilizes unidirectional conduction devices like Vacuum diode or PN junction diode.

MODELGRAPH



TABULATION:

Voltage	Peak to Peak voltage $V_{(p-p)}$ (Volts)	Maximum Voltage V_m (Volts)	Time Period (sec)	Ripple factor
Input				
Output				

Full wave rectifier:

It converts an AC voltage in to a pulsating DC voltage using both half cycles of the applied AC voltage. It uses two diodes of which one conducts during positive half cycle while the other conducts during negative half cycle. During positive half cycle of the input signal anode of the diode D1 becomes positive with respect to cathode and at the same time anode of the diode becomes negative. Hence D1 conducts and D2 will not conduct during positive half cycle. During negative half of the input anode of the diode D1 becomes negative and anode of diode D2 becomes positive. Hence D1 does not conduct and D2 will conduct. The load current flows through D2 and voltage drop across RL will be equal to the input voltage.

PROCEDURE:

1. Connect the circuit as per the circuit diagram.
2. Connect the CRO across the load.
3. from the waveform in the CRO screen, note down the amplitude and frequency along with multiplication factor.
4. Calculate the ripple factor.

RESULT:

Thus the input & output waveforms are drawn for full wave rectifiers and ripple factor calculated

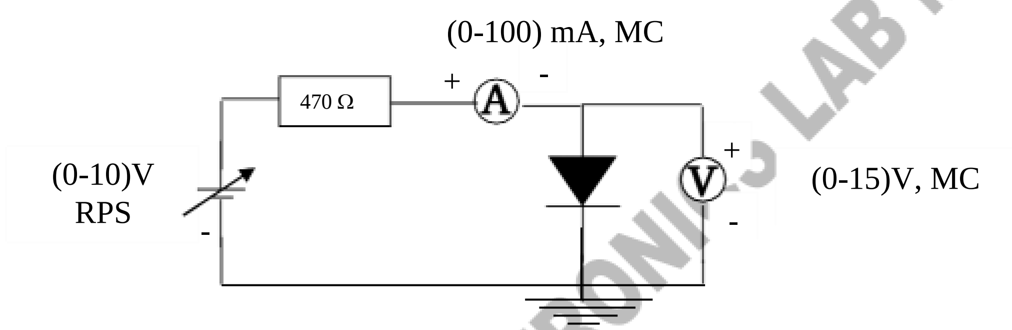
VIVA QUESTIONS:

1. Define Full wave rectifier?
2. What is the formulae for Vdc for FW Rectifier?
3. What is the formulae for Vrms for FW Rectifier
4. What type of output we get from FWRectifier?
5. What is the value of Ripple factor for FW Rectifier?

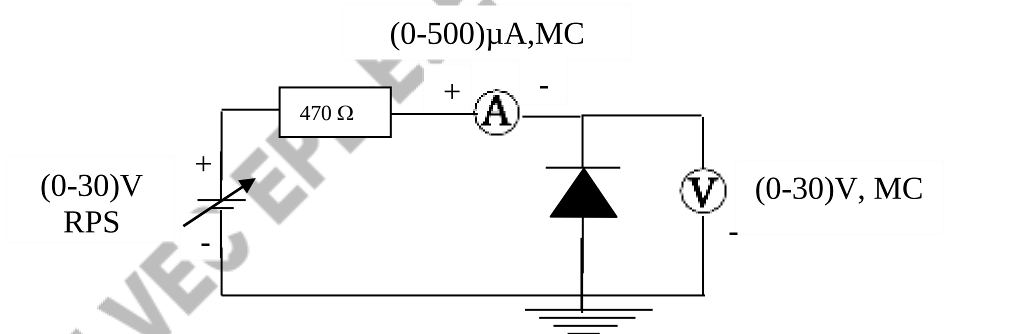
η =1 for Silicon and 2 for Germanium

CIRCUIT DIAGRAM:

FORWARD BIAS:



REVERSE BIAS:



Specification for 1N4001: Silicon Diode

Peak Inverse Voltage: 50V

Experiment beyond the Syllabus

CHARACTERISTICS OF SEMICONDUCTOR DIODE

AIM:

To study the PN junction diode characteristics under Forward & Reverse bias conditions.

APPARATUS REQUIRED:

S.No.	Name	Range	Type	Qty
1	R.P.S			
2	Ammeter			
3	Voltmeter			

COMPONENTS REQUIRED:

S.No.	Name	Range	Type	Qty
1	Diode			
2	Resistor			
3	Bread Board			
4	Wires			

THEORY:

A PN junction diode is a two terminal junction device. It conducts only in one direction (only on forward biasing).

FORWARD BIAS:

On forward biasing, initially no current flows due to barrier potential. As the applied potential exceeds the barrier potential the charge carriers gain sufficient energy to cross the potential barrier and hence enter the other region. The holes, which are majority carriers in the P-region, become minority carriers on entering the N-regions, and electrons, which are the majority carriers in the N-region, become minority carriers on entering the P-region. This injection of Minority carriers results in the current flow, opposite to the direction of electron movement.

TABULAR COLUMN:

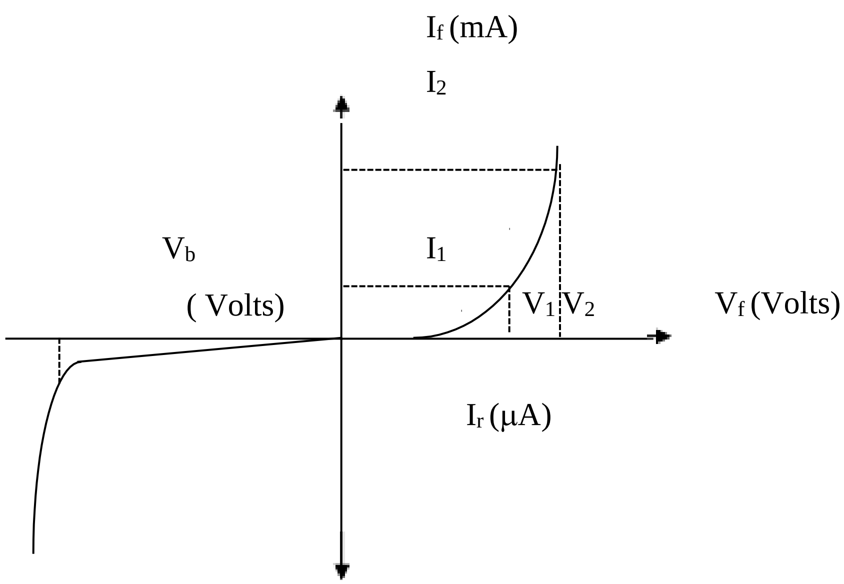
FORWARD BIAS:

S. No.	VOLTAGE (Volts)	CURRENT (mA)

REVERSE BIAS:

S. No.	VOLTAGE (Volts)	CURRENT (μA)

MODEL GRAPH



REVERSE BIAS:

On reverse biasing, the majority charge carriers are attracted towards the terminals due to the applied potential resulting in the widening of the depletion region. Since the charge carriers are pushed towards the terminals no current flows in the device due to majority charge carriers. There will be some current in the device due to the thermally generated minority carriers. The generation of such carriers is independent of the applied potential and hence the current is constant for all increasing reverse potential. This current is referred to as Reverse Saturation Current (I_O) and it increases with temperature. When the applied reverse voltage is increased beyond the certain limit, it results in breakdown. During breakdown, the diode current increases tremendously.

PROCEDURE:

FORWARD BIAS:

1. Connect the circuit as per the diagram.
2. Vary the applied voltage V in steps of 0.1V.
3. Note down the corresponding Ammeter readings I.
4. Plot a graph between V & I

OBSERVATIONS

1. Find the d.c (static) resistance = V/I.
2. Find the a.c (dynamic) resistance r = δV / δI (**r = ΔV/ΔI) =** $\frac{V_2 - V_1}{I_2 - I_1}$.
3. Find the forward voltage drop = [Hint: it is equal to 0.7 for Si and 0.3 for Ge]

REVERSE BIAS:

1. Connect the circuit as per the diagram.
2. Vary the applied voltage V in steps of 1.0V.
3. Note down the corresponding Ammeter readings I.
4. Plot a graph between V & I
5. Find the dynamic resistance **r = δV / δI.**

RESULT:

Forward and Reverse bias characteristics of the PN junction diode and the dynamic resistance under

i) Forward bias = ---------------------

ii) Reverse bias = ----------------------.

iii) Reverse Saturation Current = --------.

VIVA – VOCE QUESTION

SEMICONDUCTOR DIODE AND ZENER – DIODE

1. Define knee voltage of a diode.
2. Draw VI characteristics of PN junction diod
3. Although Zener diode is operated in the reverse breakdown region, but it does not burn. Why?
4. Differentiate between static and dynamic resistance of a diode.
5. Differentiate between avalanche and Zener breakdown.