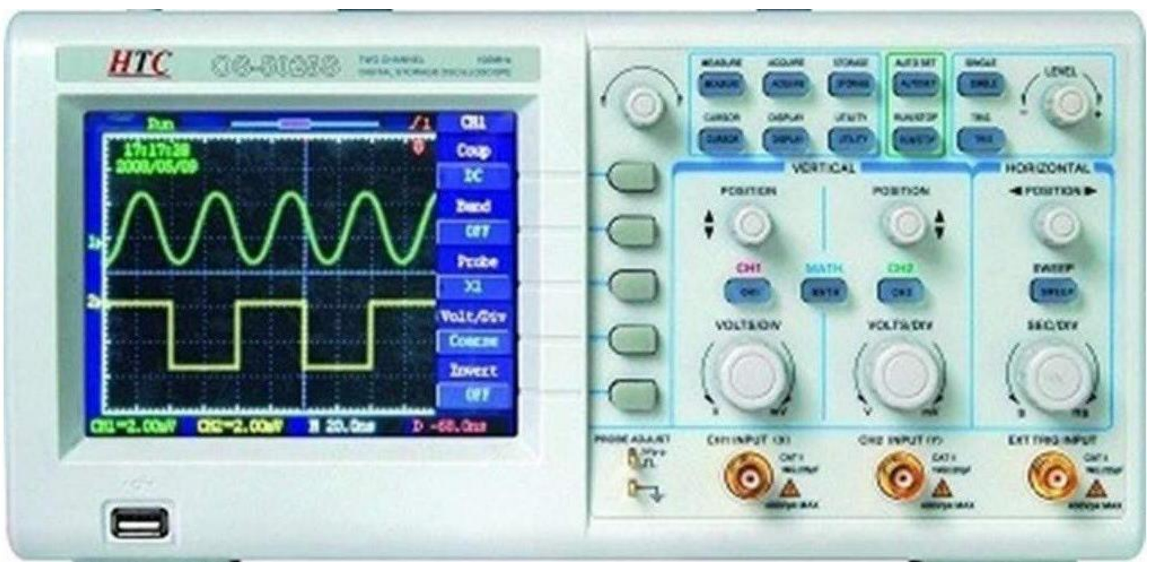
MARRI LAXMAN REDDY
INSTITUTE OF TECHNOLOGY AND MANAGEMENT
(AN AUTONOMOUS INSTITUTION)
(Approved by AICTE, New Delhi & Affiliated to JNTUH, Hyderabad)
Accredited by NBA and NAAC with 'A' Grade & Recognized Under Section2(f) & 12(B)of the UGC act,1956

LABORATARY MANUAL OF
ELECTRONIC DEVICES AND CIRCUITS LAB

II YEAR B.TECH I-SEM ECE (R24)



A.Y.2025-26

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

PREPARED BY

Mr. G. SIVA SANKAR VARMA, Asst. Prof
Mrs. P. LAVANYA, Asst.Prof
Mr. M. KRANTHI KUMAR, Asst.Prof

CERTIFICATE

This is to certify that this manual is a bonafide record of practical work in the ***Electronic Devices and Circuits Laboratory*** in **First Semester of II-year B. Tech (ECE) programme** during the academic year **2025-2026.** This book is prepared by **Mr. G. SIVA SANKAR VARMA, Asst. Professor, Mrs. P. LAVANYA, Asst. Professor, Mr. M. KRANTHI KUMAR, Asst.Prof** Department of Electronics and Communication Engineering.

Head of the Department

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PREFACE

This laboratory lays the foundation for the Electronics and Communication Engineering students during first year of their course. In the EDC LAB students will perform experiments on different electronic circuits and will observe its characteristics.

BY

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ACKNOWLEDGEMENT

It was really a good experience, working with Electronic Devices and Circuits lab. First we would like to thank Dr. N. Srinivas, Professor, HOD of Department of Electronics and Communication Engineering, Marri Laxman Reddy Institute of technology & Management for his concern and giving the technical support in preparing the document.

We are deeply indebted and gratefully acknowledge the constant support and valuable patronage of Dr. R. Murali Prasad, Principal, Marri Laxman Reddy Institute of technology & Management for giving us this wonderful opportunity for preparing the Electronic Devices and Circuits laboratory manual.

We express our hearty thanks to Dr. P. Sridhar, Director, Marri Laxman Reddy Institute of technology & Management, for timely corrections and scholarly guidance. At last, but not the least I would like to thanks the entire ECE Department faculty those who had inspired and helped us to achieve our goal.

BY

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GENERAL INSTRUCTIONS

1. Students are instructed to come to Electronic Devices and Circuits laboratory on time. Late comers are not entertained in the lab.
2. Students should be punctual to the lab. If not, the conducted experiments will not be repeated.
3. Students are expected to come prepared at home with the experiments which are going to be performed.
4. Students are instructed to display their identity cards before entering into the lab.
5. Students are instructed not to bring mobile phones to the lab.
6. Any damage/loss of equipments like transformers, transistors, CRO's etc., during the lab session, it is student's responsibility and penalty or fine will be collected from the student.
7. Students should update the records and lab observation books session wise. Before leaving the lab the student should get his lab observation book signed by the faculty.
8. Students should submit the lab records by the next lab to the concerned faculty members in the staffroom for their correction and return.
9. Students should not move around the lab during the lab session.
10. If any emergency arises, the student should take the permission from faculty member concerned in written format.
11. The faculty members may suspend any student from the lab session on disciplinary grounds.
12. Never copy the output from other students. Write down your own outputs.

Vision of the Institute

To be a globally recognized institution that fosters innovation, excellence, and leadership in education, research, and technology development, empowering students to create sustainable solutions for the advancement of society.

Mission of the Institute

To foster a transformative learning environment that empowers students to excel in engineering, innovation, and leadership.

To produce skilled, ethical, and socially responsible engineers who contribute to sustainable technological advancements and address global challenges.

To shape future leaders through cutting-edge research, industry collaboration, and community engagement.

Quality Policy

The management is committed in assuring quality service to all its stakeholders, students, parents, alumni, employees, employers, and the community.

Our commitment and dedication are built into our policy of continual quality improvement by establishing and implementing mechanisms and modalities ensuring accountability at all levels, transparency in procedures, and access to information and actions.

Vision of the Department

To provide quality technical education in Electronics and Communication Engineering through research, innovation, striving for global recognition in specified domain, leadership, and sustainable societal solutions.

Mission of the Department

- **DM1:** To create a transformative learning environment that empowers students in electronics and communication engineering, fostering excellence in technical skills and leadership.
- **DM2:** To drive innovation through research, deliver a transformative education grounded in ethical principles, and nurture the development of professionals
- **DM3:** To cultivate strong industry partnerships, and engaging actively with the community for societal and technological progress.

Program Educational Objectives (PEO)

PEO 1: Have successful careers in Industry.
PEO 2: Show excellence in higher studies/ Research.
PEO 3: Show good competency towards Entrepreneurship.

Program Outcomes (POs)

Engineering Graduates will be able to:

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

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.
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.
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.
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.
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.
7. **Environment and sustainability**: Underst and the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
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.
11. **Project management and finance**: Demonstrate knowledge and underst and ing 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.

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.

Program Specific Outcomes (PSOs)

1. Analyze and design analog & digital circuits or systems for a given specification and function.
2. Implement functional blocks of hardware-software co-designs for signal processing and communication applications.

COURSE STRUCTURE, OBJECTIVES & OUTCOMES

Laboratory subjects – Internal and external evaluation– Details of marks

- Electronic Devices and Circuits lab will have a continuous evaluation during 2nd semester for 40 sessional marks and 60 end semester examination marks.

- Out of the 40 marks for internal evaluation, day-to-day work in the laboratory shall be evaluated for 20 marks and internal practical examination shall be evaluated for 20 marks conducted by the laboratory teacher concerned.

- The end examination will be evaluated for a maximum of 60 marks. The end semester examination shall be conducted with an external examiner and internal examiner. The external examiner shall be appointed by the principal / Chief Controller of examinations

Course Objectives:

The students will try to learn

- V-I Characteristics of diode and its applications
- Characteristics of non-linear wave shaping circuits.
- Input and output Characteristics of BJET and FET
- Implementation of BJT applications
- Frequency response of BJT and FET amplifiers

Course Outcomes:

After successful completion of the course, students shall be able to

- Demonstrate the PN-diode and its applications
- Analyze the non-linear wave shaping circuits
- Determine I/O characteristics of BJET and FET configurations
- Build applications of BJT
- Compare the frequency response of BJT and FET amplifiers.

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2430471: ELECTRONIC DEVICES AND CIRCUITS LABORATORY

II Year B.Tech. ECE I – Sem.

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0	0	2	1

Couse Overview:
This course is intended to Illustrates the working of Basic elements of EDC, different Transistors and their applications, the experiments in this course provide essential hands-on experience and theoretical knowledge that are critical for a deep understanding of both Electronic Devices and Electronic Circuits. This course can be applied in Consumer Electronics, Medical Devices, Aerospace and Defense, and Robotics, Industrial Control Systems.

Pre-requisites: Knowledge about electronic devices and circuits is required

Course Objectives:
The students will try to learn
- V-I Characteristics of diode and its applications
- Characteristics of non-linear wave shaping circuits.
- Input and output Characteristics of BJET and FET
- Implementation of BJT applications
- Frequency response of BJT and FET amplifiers

Course Outcomes:
After successful completion of the course, students shall be able to
- Demonstrate the PN-diode and its applications
- Analyze the non-linear wave shaping circuits
- Determine I/O characteristics of BJET and FET configurations
- Build applications of BJT
- Compare the frequency response of BJT and FET amplifiers.

List of Experiments:
1. PN Junction diode characteristics: (a) Forward bias (b) Reverse bias

2. Half Wave Rectifier with & without filters
3. Full Wave Rectifier with & without filters
4. Clippers at different reference voltages
5. Clampers at different reference voltages
6. Input and output characteristics of BJT in CE Configuration
7. Frequency Response of CE amplifier
8. Logic gates using BJT
9. Voltage level indicator
10. Input and output characteristics of FET in CS Configuration
11. Frequency Response of Common Source FET amplifier
12. Transistor as a switch to control the on–off states of a bulb
13. Zener diode as a voltage regulator
14. Verify the SCR Characteristics

NOTE: Minimum of 12 experiments to be conducted.

Experiment No. 1

PN JUNCTION DIODE CHARACTERISTICS

AIM:

To plot the V-I characteristics of a PN junction diode in both forward and reverse directions.

COMPONENTS & EQUIPMENT REQUIRED:

S.No	Device	Range /Rating	Quantity (in No.s)
1.	Semiconductor diode trainer Board Containing DC Power Supply. Diode (Silicon) Diode (Germanium) Carbon Film Resistor	(0-15) V 1N 4007 OA79 1 KΩ, 1/2 W	1 1 1 1
2.	DC Voltmeter DC Voltmeter	(0-1) V (0-20) V	1 1
3.	DC Ammeter DC Ammeter	(0-200) µA (0-20) mA	1 1
4.	Connecting wires	5A	10

THEORY

A p-n junction diode conducts only in one direction. The V-I characteristics of the diode are curve between voltage across the diode and current through the diode. When external voltage is zero, circuit is open and the potential barrier does not allow the current to flow. Therefore, the circuit current is zero. When P-type (Anode is connected to +ve terminal and n- type (cathode) is connected to –ve terminal of the supply voltage, is known as forward bias. The potential barrier is reduced when diode is in the forward biased condition. At some forward voltage, the potential barrier altogether eliminated and current starts flowing through the diode and also in the circuit. The diode is said to be in ON state. The current increases with increasing forward voltage. When N-type (cathode) is connected to +ve terminal and P-type (Anode) is connected –ve terminal of the supply voltage is known as reverse bias and the potential barrier across the junction increases. Therefore, the junction resistance becomes very high and a very small current (reverse saturation current) flows in the circuit. The diode is said to be in OFF state. The reverse bias current due to minority charge carriers.

CIRCUIT DIAGRAM :

Forward bias :

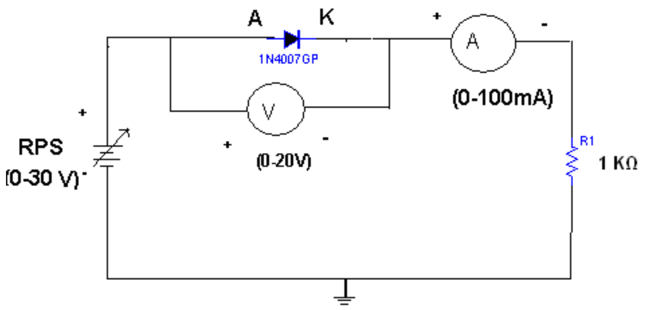


Fig 1.1 Circuit diagram of Forward bias of a PN junction Diode

Reverse bias :

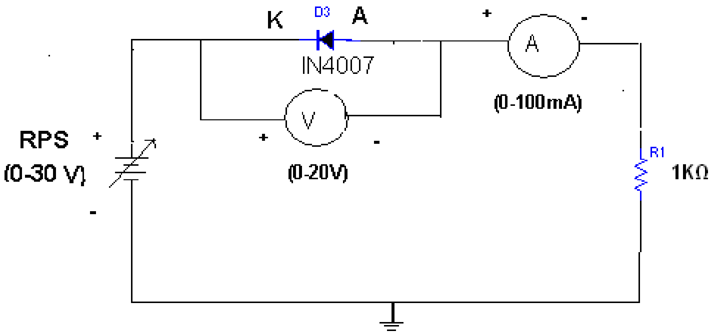


Fig 1.2 Circuit diagram of Forward bias of a PN junction Diode

PROCEDURE :

Forward Bias :

1. Connect the circuit as shown in figures (1)
2. Vary the supply voltage E_s in steps and note down the corresponding values of E_f and I_f as shown in the tabular column.

Reverse Bias :

1. Connect the circuit as shown in figure (2).
2. Repeat the procedure as in forward bias and note down the corresponding Values of E_r and I_r as shown in the tabular column.

TABULAR COLUMN :

FORWARD BIAS

Vs ()	Vf (volts)	If (mA)

REVERSE BIAS

VS	Vr	Ir

EXPECTED GRAPH

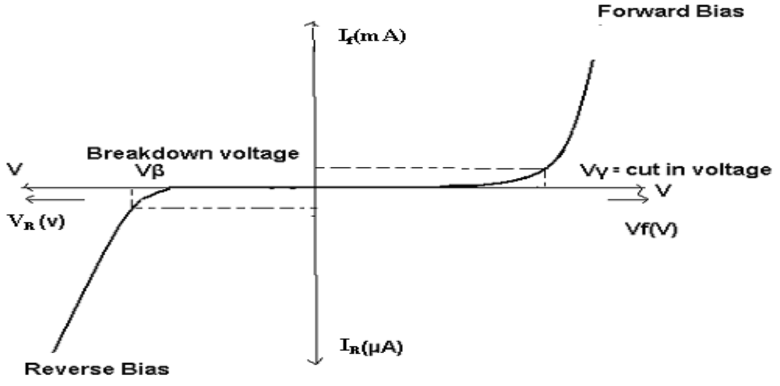


Fig 1.3 Expected waveform of a PN junction Diode characteristics

RESULT:
Thus, V-I characteristics of a PN junction diode in both forward and reverse bias are studied and plotted

VIVA QUESTIONS:

1. What is P-N junction diode?
2. What is doping why doping is necessary?
3. Difference between P-type and N-type semiconductor materials?
4. What is diode equation?
5. What is an ideal diode?

6. Define depletion region of a diode?
7. What is meant by transition & space charge capacitance of a diode?
8. Is the V-I relationship of a diode Linear or Exponential?
9. Define cut-in voltage of a diode and specify the values for Si and Ge diodes?
10. What are the applications of a p-n diode?
11. Draw the ideal characteristics of P-N junction diode?
12. What is the diode equation?
13. What is the break down voltage?
14. What is the effect of temperature on PN junction diodes?
15. What is PIV?
16. What is Forward bias?
17. What is Reverse bias?
18. What is Forward voltage?
19. What is Reverse current?
20. What is an ideal diode?
21. What is Break down voltage?
22. What is cut-in volatge?
23. Is the V-I relationship of a diode Linear or Exponential?
24. Define diode?
25. What are the characterstics of diode?
26. Draw the ideal characteristics of P-N junction diode?
27. What is the diode characterstics?
28. What is the break down voltage in diode?
29. What is the effect of PN junction diodes?
30. What is PVI?

APPLICATIONS:

1. PN junction (which has direct energy band gap) in forward biased condition produces light when biased with a current. All LED lighting uses a PN junction diode.
2. Voltage across PN junction biased at a constant current has a negative temperature coefficient. Difference between the PN junction voltages of two differently biased diodes has a positive temperature coefficient. These properties are used to create Temperature Sensors, Reference voltages (Band gap).
3. Various circuits like Rectifiers, Varactors for Voltage Controlled Oscillators (VCO) etc

EXP NO: 2

ZENER DIODE AS A VOLTAGE REGULATOR

AIM :

Plot the V-I characteristics of a Zener diode, find zener breakdown voltage in reverse bias condition and perform zener diode voltage regulator.

COMPONENTS REQUIRED :

S.NO	DEVICES	RANGE /RATING	QUANTITY (in No.s)
1.	Zener diode trainer Board Containing a) DC Power Supply. b) Zener Diode c) Zener Diode d) Carbon Film Resistor	 (0-15) V 4.7 V 6.2 V 1 KΩ, 1/2 W	 1 1 1 1
2.	DC Voltmeter DC Voltmeter	(0-1) V (0-20) V	1 1
3.	a) DC Ammeter b) DC Ammeter	(0-200) μA (0-20) mA	1 1
4.	Connecting wires	5A	10

THEORY

A zener diode is heavily doped p-n junction diode, specially made to operate in the break down region. A p-n junction diode normally does not conduct when reverse biased. But if the reverse bias is increased, at a particular voltage it starts conducting heavily. This voltage is called Break down Voltage. High current through the diode can permanently damage the device.

To avoid high current, we connect a resistor in series with zener diode. Once the diode starts conducting it maintains almost constant voltage across the terminals whatever may be the current through it, i.e., it has very low dynamic resistance. It is used in voltage regulators.

CIRCUIT DIAGRAM :

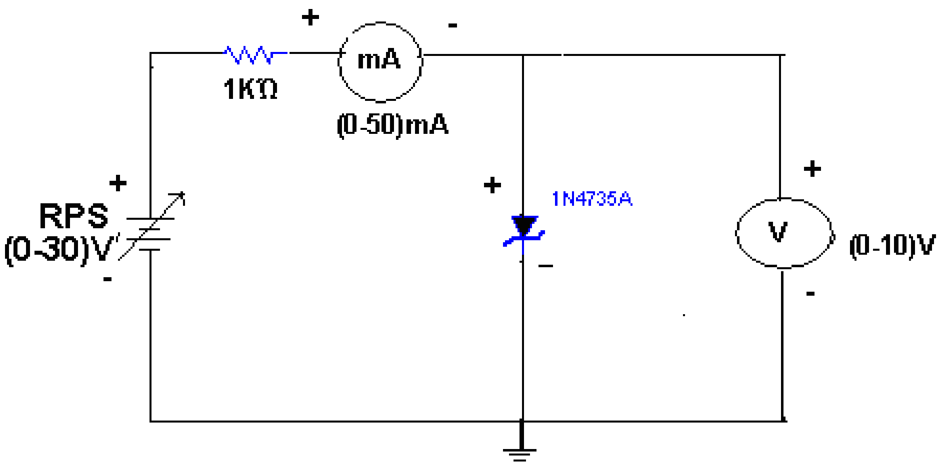


Fig Circuit diagram of Forward bias of a Zener Diode

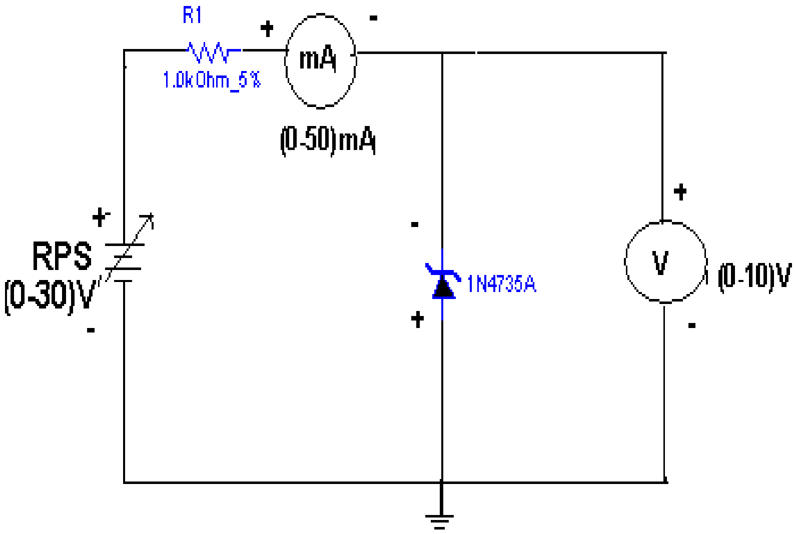


Fig Circuit diagram of Reverse bias of a Zener Diode

PROCEDURE :

Forward Bias

- Connect the circuit as shown in figures (1)
- Vary the supply voltage E_s in steps and note down the corresponding values of E_f and I_f as shown in the tabular column

EXPECTED GRAPH

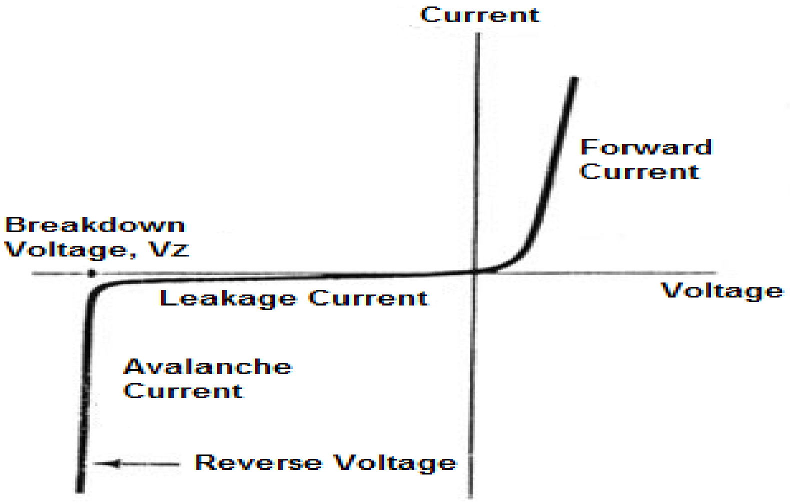


Fig Expected waveform Zener Diode Characteristics

TABULAR COLUMN

REVERSE BIAS

E_s ()	E_r (volts)	I_r (mA)

RESULT: Thus, V-I characteristics of a Zener Diode under forward and reverse bias are studied and plotted

VIVA QUESTIONS:

1. What is Zener diode?
2. Can Zener be used as a rectifier?
3. What are the voltage ratings of zener diode?
4. Give advantages of zener diode?
5. How zener diode behaves in foreard bias?
6. What type of temp? Coefficient does the zener diode have?

7. If the impurity concentration is increased, how the depletion width effected?
8. Does the dynamic impendence of a zener diode vary?
9. Explain briefly about avalanche and zener breakdowns?
10. Draw the zener equivalent circuit?
11. Differentiate between line regulation & load regulation?
12. In which region zener diode can be used as a regulator?
13. How the breakdown voltage of a particular diode can be controlled?
14. What type of temperature coefficient does the Avalanche breakdown has?
15. By what type of charge carriers, the current flows in zener and avalanche breakdown diodes?
16. What is static characterstics of diode?
17. Can Zener be used as a integrator?
18. What are the rating voltages of zener diode?
19. Give disadvantages of zener diode?
20. How zener diode behaves in forward bias?
21. What type of temp Coefficient does the zener diode have?
22. If the impurity concentration is decreased, how the depletion width effected?
23. Does the dynamic impendence of a diode vary?
24. Explain briefly about avalanche breakdown?
25. Draw the zener equal circuit?
26. Differentiate between line & load regulation?
27. In which region zener diode can be used as a integratorr?
28. How the cut in voltage of a particular diode can be controlled?
29. What type of temperature coefficient does the zener breakdown has?
30. what type of charge carriers the voltage flows in zener and avalanche breakdown diodes?
31. Find the difference between P-N junction Diode and Zener diode in forward bias condition?
32. Find the difference between P-N junction Diode and Zener diode in Reverse bias condition?
33. Find the Break down voltage for given Zener Diode?
34. Define what happens to a series current, load current and zener current when the dc input voltage of zener regulator increases.
35. How does the Zener breakdown voltage varies with temperature.

REALTIME APPLICATIONS:

With growing popularity of smart phones, android based projects are being preferred these days. These projects involve use of Bluetooth technology based device. These Bluetooth devices require about 3V voltage for operation. In such cases, a zener diode is used to provide a 3V reference to the Bluetooth device. Another application involves use of Zener diode as a voltage regulator. Here the AC voltage is rectified by the diode D1 and filtered by the capacitor. This filtered DC voltage is regulated by the diode to provide a constant reference voltage of 15V. This regulated DC voltage is used to drive the control circuit, used to control the switching f light, as in an automated lighting control system.

EXP NO: 3

HALF AND FULL WAVE RECTIFIER WITH AND WITHOUT FILTER

EXP NO: 3A
HALF WAVE RECTIFIER WITH AND WITHOUT FILTER

AIM: To Rectify the AC signal and then to find out Ripple factor and percentage of Regulation in Half wave rectifier with and without Capacitor filter.

APPARATUS:

S.No	Name	Range / Value	Quantity
1	Transformer	230V / 0 - 9V	1
2	Diode	1N4001	1
3	Capacitors	1000µF/16V, 470µF/25V	1
4	Decade Resistance Box	470Ω	1
5	Multimeter		1
6	Bread Board and connecting wires	-	1 Set
7	Dual Trace CRO	20MHz	1

CIRCUIT DIAGRAM:

WITHOUT FILTER

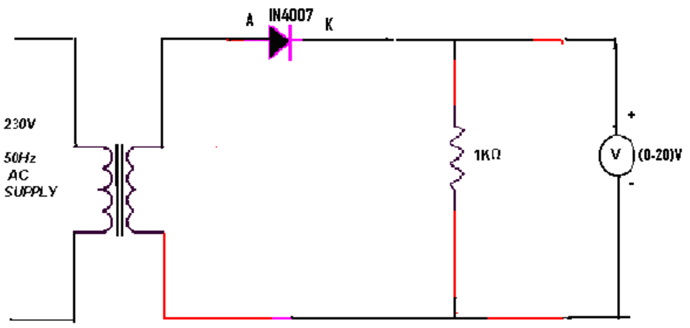


Fig: 1 Circuit Diagram of Half Wave Rectifier Without Filter

WITH FILTER

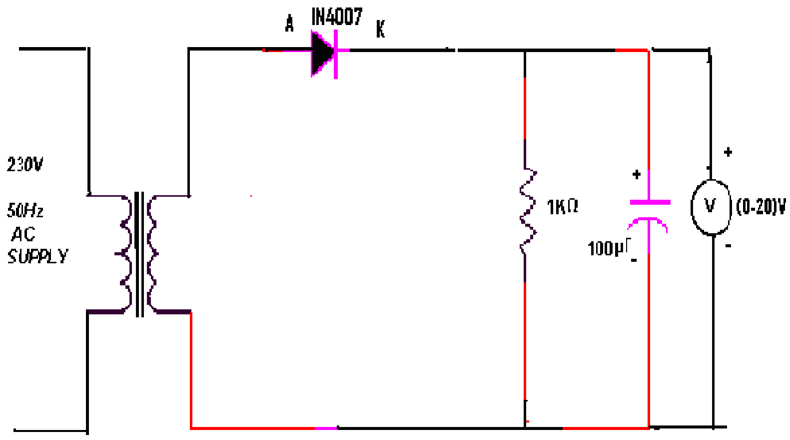


Fig: 2 Circuit diagram of Half Wave Rectifier With Filter

PROCEDURE:

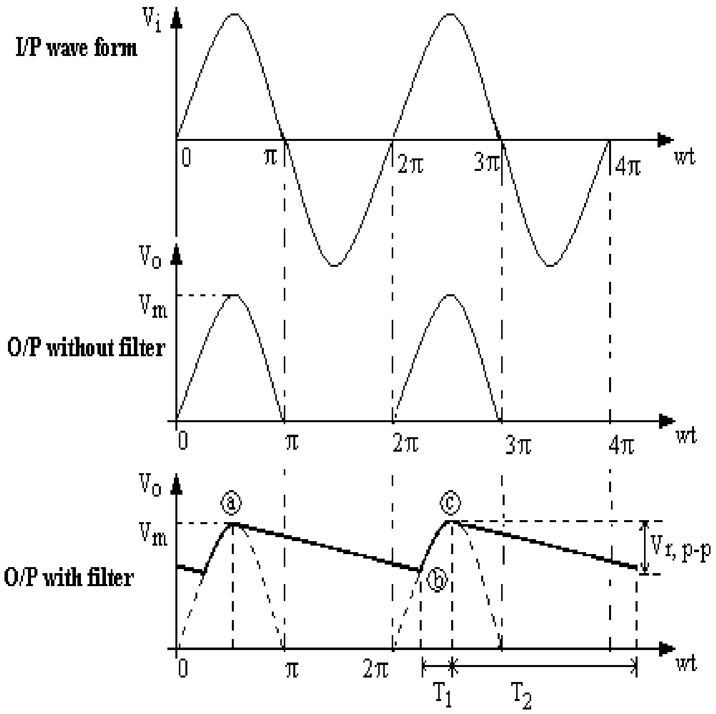
WITHOUT FILTER:

1. Connecting the circuit on bread board as per the circuit diagram
2. Connect the primary of the transformer to main supply i.e. 230V, 50Hz
3. Connect the decade resistance box and set the R_L value to 100Ω
4. Connect the Multimeter at output terminals and vary the load resistance (DRB) from 100Ω to 1KΩ and note down the Vac and Vdc as per given tabular form
5. Disconnect load resistance (DRB) and note down no load voltage Vdc ($V_{no\ load}$)
6. Connect load resistance at 1KΩ and connect Channel – II of CRO at output terminals and CH – I of CRO at Secondary Input terminals observe and note down the Input and Output Wave form on Graph Sheet.
7. Calculate ripple factor $= \dfrac{V_{ac}}{V_{dc}}$
8. Calculate Percentage of Regulation, % $\dfrac{V_{no\ load} - V_{full\ load}}{V_{no\ load}} * 100\%$

WITH CAPACITOR FILTER:

1. Connecting the circuit as per the circuit Diagram and repeat the above procedure from steps 2 to 8

EXPECTED WAVEFORMS :



Half-wave Rectifier with capacitor filter wave form

CALCULATIONS.

VNL= --------- volts

SL No	RL (Ohm)	VFL=Vdc	Vac	Ripple factor =Vac/Vdc	% Regulation

Without Filter:

Ripple Factor :
Regulation :

With Capacitor Filter:

Ripple Factor :
Regulation :

RESULT:
Observe Input and Output Wave forms and Calculate ripple factor and percentage of regulation in Half wave rectifier with and without filter.

VIVA QUESTIONS:

1. What is the PIV of Half wave rectifier?
2. What is the efficiency of half wave rectifier?
3. What is the rectifier?
4. What is the difference between the half wave rectifier and full wave rectifier?
5. What is the o/p frequency of Bridge Rectifier?
6. What are the ripples?
7. What is the function of the filters?
8. What is TUF?
9. What is the average value of o/p voltage for HWR?
10. What is the peak factor?
11.What is the PIV of Half wave rectifier?
12. What is the efficiency of half wave rectifier?
13. What is the rectifier?
14. What is the difference between the half wave rectifier and full wave rectifier?
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24. What is the difference between the half wave rectifier and full wave rectifier?
25. What is the o/p frequency of Bridge Rectifier?
26. What are the ripples?
27. What is the function of the filters?
28. What is TUF?
29. What is the average value of o/p voltage for HWR?
30. What is the peak factor?
31. Give the importance of peak inverse voltage

32.Define why half wave rectifier is not in dc power supply

33.Why diodes are not operated in the breakdown region in rectifiers.

34.The output of the 60Hz full wave bridge rectifier had a 60Hz ripple.Is this circuit working properly.

35.Define why series Inductor and L-section filters cannot be used with half-wave rectifier

36.Why capacitor input filter is preferred to choke input filter.

37.Define ripple as referred to in a rectifier circuit.

38. What is load regulation and line regulation in power supplies?

39. What are the different types of filters used for the rectifiers?

40. Which is preferable- High regulation or low regulation?

.

EXP NO: 3B

FULL WAVE RECTIFIER

AIM: To Rectify the AC signal and then to find out Ripple factor and percentage of Regulation in Half wave rectifier with and without Capacitor filter.

APPARATUS:

S.No	Name	Range / Value	Quantity
1	Transformer	230V / 0 - 9V	1
2	Diode	1N4001	1
3	Capacitors	1000□F/16V, 470□f/25V	1
4	Decade Resistance Box	-	1
5	Multimeter	-	1
6	Bread Board and connecting wires	-	1 Set
7	Dual Trace CRO	20MHz	1

CIRCUIT DIAGRAM :

FULL WAVE RECTIFIER WITH FILTER :

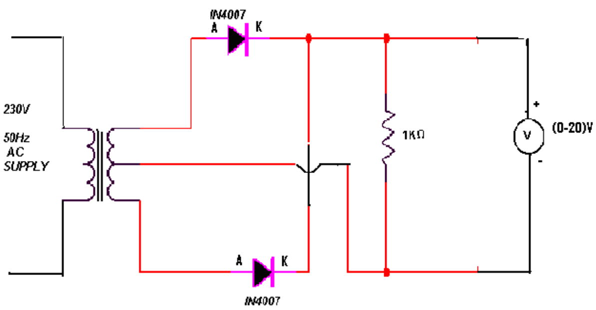


Fig 1 circuit diagram of full wave rectifier without filter

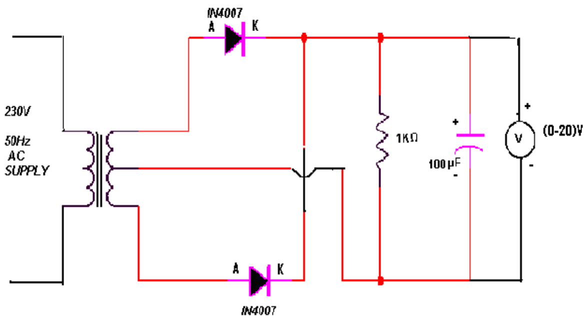


Fig 2 circuit diagram of full wave rectifier with filter

PROCEDURE

WITHOUT FILTER:

1. Connecting the circuit on bread board as per the circuit diagram
2. Connect the primary of the transformer to main supply i.e. 230V, 50Hz
3. Connect the decade resistance box and set the R_L value to 100Ω
4. Connect the Multimeter at output terminals and vary the load resistance (DRB) from 100Ω to 1KΩ and note down the Vac and Vdc as per given tabular form
5. Disconnect load resistance (DRB) and note down no load voltage Vdc ($V_{no\ load}$)
6. Connect load resistance at 1KΩ and connect Channel – II of CRO at output terminals and CH – I of CRO at Secondary Input terminals observe and note down the Input and Output Wave form on Graph Sheet.
7. Calculate ripple factor

8. Calculate Percentage of Regulation, % = $\frac{V_{\text{no load}} - V_{\text{fullload}}}{V_{\text{no load}}}$

WITH CAPACITOR FILTER:

1. Connecting the circuit as per the circuit Diagram and repeat the above procedure from steps 2 to 8

With filter:

1. Connect a capacitor (100µf/35V) across the load resistance RL..
2. Note down the voltage across the secondary of transformer and across the output terminals (Vo) i.e. across load resistor RL (with 1K, 4.7K, 10K, 100k) use DRB Decade resistance box or discrete component.
3. Vary the RL load resistor for different values note down AC and DC voltages across the RL using DMM or CRO.
4. Now Disconnect the RL and note the No Load voltage VNL.

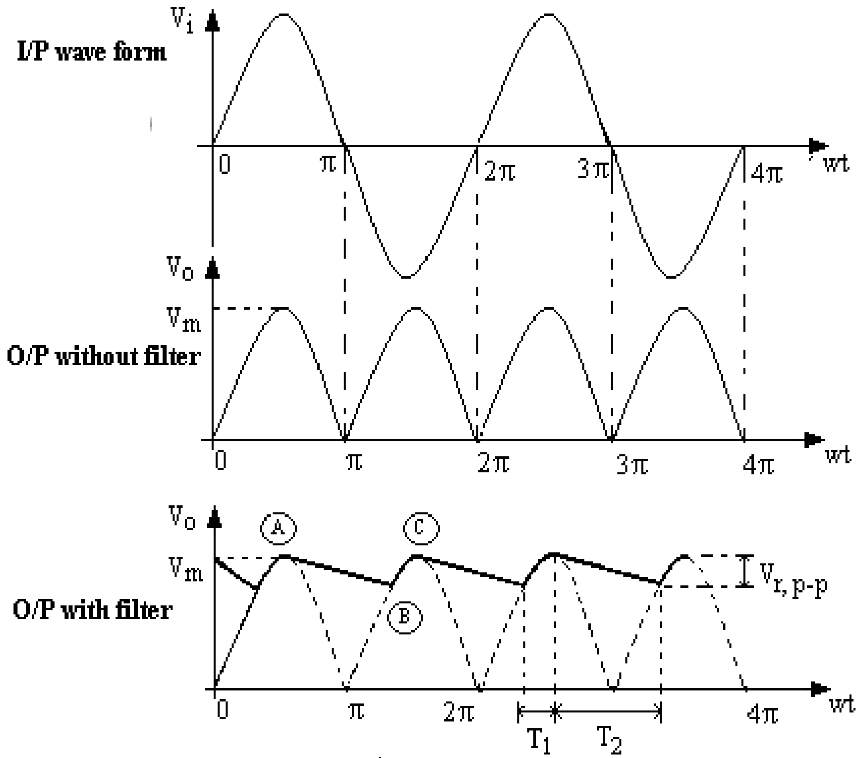
Calculate the ripple factor & regulation using formula for different loads and tabulate

TABULAR FORMS:

VNL= --------- volts

S.No	RL (Ohm)	VFL=Vdc	Vac	Ripple factor=Vac/Vdc		% Regulation	
				With filter	Without filter	With filter	Without filter

EXPECTED WAVEFORMS:



Full-wave Rectifier with capacitor filter wave form

Fig Output Waveforms of Full Wave Rectifier

THEORITICAL CALCULATIONS:-

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

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

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

(**i)Without filter**:

Ripple factor, $r = \sqrt{(V_{rms}/V_{dc})^2 - 1} = 0.482$

(ii)With filter:

Ripple factor, $r = 1/(4\sqrt{3}\, f\, C\, R_L)$ where $f = 50Hz$

$C = 100\mu F$ $R_L = 1K\Omega$

PRECAUTIONS:

1. Check the wires for continuity before use.
2. Keep the power supply at Zero volts before Start.
3. All the contacts must be intact.

RESULT: Observe Input and Output Wave forms and Calculate ripple factor and percentage of regulation in Full-wave rectifier with and without filter.

REAL TIME APPLICATIONS

The full wave rectifier circuit is one that is widely used for power supplies and many other areas where a full wave rectification is required.

The full wave rectifier circuit is used in most rectifier applications because of the advantages it offers. While it is a little more complicated, this normally outweighs the disadvantages. However sometimes it may not be optimum or necessary to use a full wave rectifier circuit

VIVA QUESTIONS

1. What is the PIV of Half wave rectifier?
2. What is the efficiency of half wave rectifier?
3. What is the rectifier?
4. What is the difference between the half wave rectifier and full wave rectifier?
5. What is the o/p frequency of Bridge Rectifier?
6. What are the ripples?
7. What is the function of the filters?
8. What is TUF?

9. What is the average value of o/p voltage for HWR?
10. What is the peak factor?
11.What is the PIV of Half wave rectifier?
12. What is the efficiency of half wave rectifier?
13. What is the rectifier?
14. What is the difference between the half wave rectifier and full wave rectifier?
15. What is the o/p frequency of Bridge Rectifier?
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22. What is the efficiency of half wave rectifier?
23. What is the rectifier?
24. What is the difference between the half wave rectifier and full wave rectifier?
25. What is the o/p frequency of Bridge Rectifier?
26. What are the ripples?
27. What is the function of the filters?
28. What is TUF?
29. What is the average value of o/p voltage for HWR?
30. What is the peak factor?
31. Give the importance of peak inverse voltage
32.Define why half wave rectifier is not in dc power supply
33.Why diodes are not operated in the breakdown region in rectifiers.
34.the output of the 60Hz full wave bridge rectifier had a 60Hz ripple.Is this circuit working properly.
35.Define why series Inductor and L-section filters cannot be used with half-wave rectifier

EXP: 4

TYPES OF CLIPPERS AT DIFFERENT REFERENCE VOLTAGES

AIM:

To study the clipping circuits for different reference **voltages** and **to** verify the responses.

COMPONENTS REQUIRED:

1. Resistors - 1KΩ
2. IN4007 Diode – 2No.
3. Bread board.
4. CRO (1Hz – 20MHz)
5. Function Generator(1Hz-1MHz)
6. Power supply(0-30V)
7. Connecting wires.

THEORY:

The non-linear semiconductor diode in combination with resistor can function as clipper circuit. Energy storage circuit components are not required in the basic process of clipping.

These circuits will select part of an arbitrary waveform which lies above or below some particular reference voltage level and that selected part of the waveform is used for transmission. So they are referred as voltage limiters, current limiters, amplitude selectors or slicers.

There are three different types of clipping circuits.

1) Positive Clipping circuit.

2) Negative Clipping.

3) Positive and Negative Clipping (slicer).

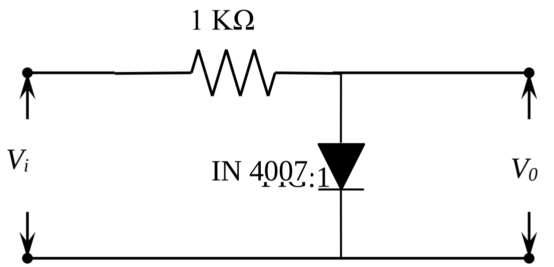
In positive clipping circuit positive cycle of Sinusoidal signal is clipped and negative portion of sinusoidal signal is obtained in the output of reference voltage is added, instead of complete positive cycle that portion of the positive cycle which is above the reference voltage value is clipped.

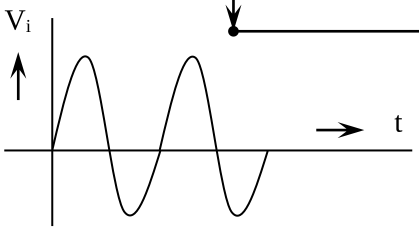
In negative clipping circuit instead of positive portion of sinusoidal signal, negative portion is clipped.

In slicer both positive and negative portions of the sinusoidal signal are clipped.

CIRCUIT DIAGRAM :

I. Positive Clipping





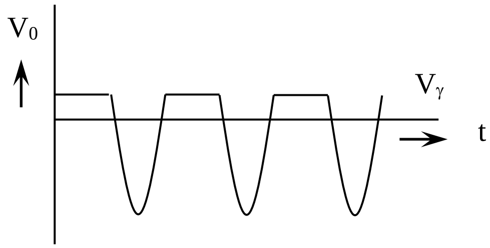
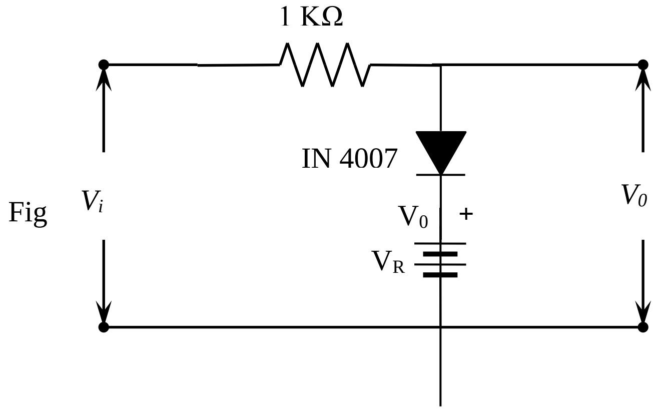


Fig: (a). Input waveform **Fig: (b)Output waveform.**

V_i is a input sinusoidal signal as shown in the figure (a) . For positive portion of the sinusoidal the diode IN4007 gets forward biased. The output voltages in the voltage across the diode under forward biased which is cut-in-voltage of the diode. Therefore the positive portion above the cut-in-voltage is clipped or not observed in the output (V_0) as shown in figure (b).

II. Positive Clipping with Positive Reference Voltage



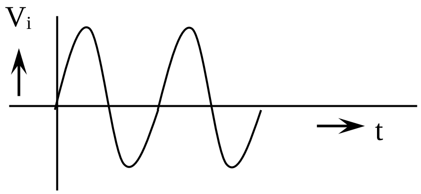


Figure:Input waveform

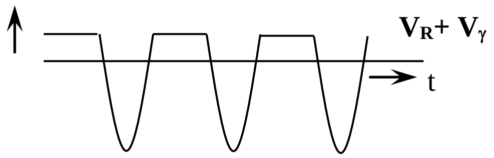


Figure: Output waveform

Positive Clipping with Negative Reference Voltage

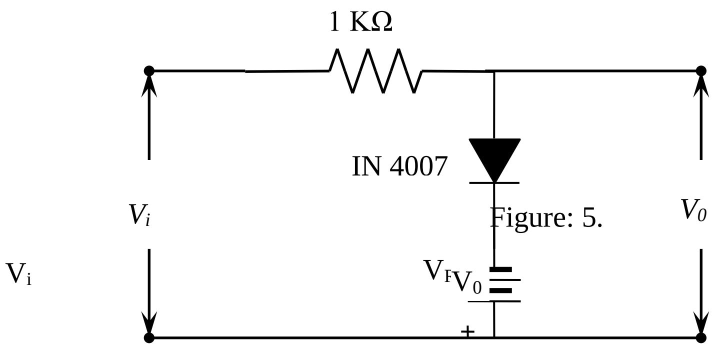
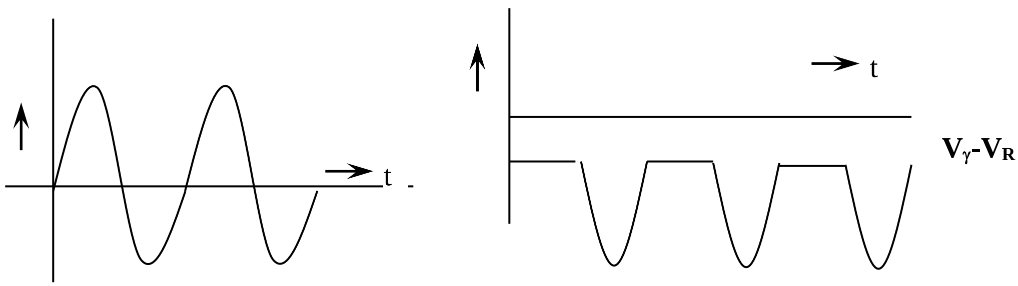
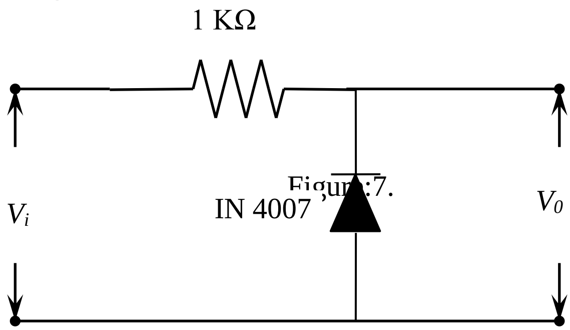


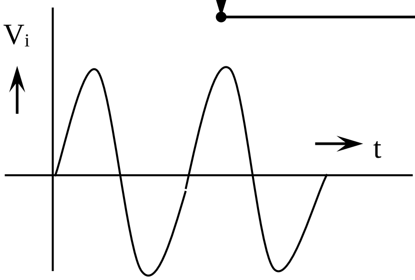
Figure: 5.



In this circuit the diode conducts the output voltage is same as input voltage. The diode conducts at a voltage less by V_R from cut-in-voltage called as V_γ. For voltage less than V_γ, the diode is open circuited and output is same as input voltage.

IV Negative Clipping Circuit





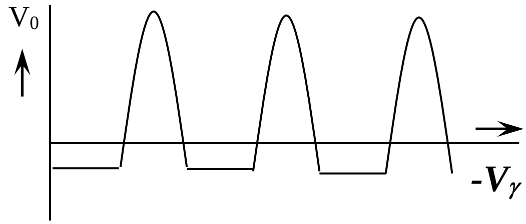


Fig: Input waveform **Fig: Output waveform.**

For this portion of the input sinusoidal signal *(V_i)*, the diode gets reverse biased and it is open. Then the output voltage is same as input voltage. For the negative portion of the signal the diode gets forward biased and the output voltage is the cut-in-voltage (*$-V_\gamma$*) of the diode. Then the input sinusoidal variation is not seen in the output. Therefore the negative portion of the input sinusoidal signal *(V_i)* is clipped in the output signal *(V)*

V. Negative Clipping with Negative Reference Voltage

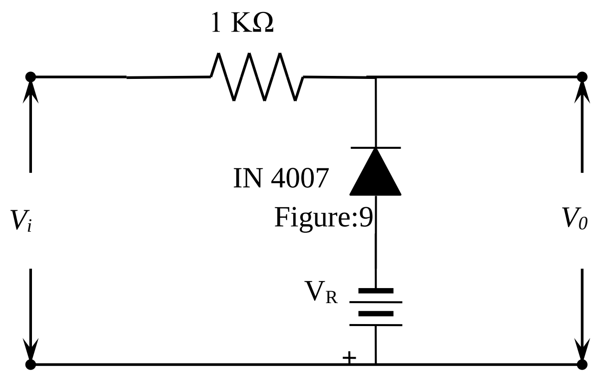


Fig Circuit of Negative Clipping with Negative Reference Voltage

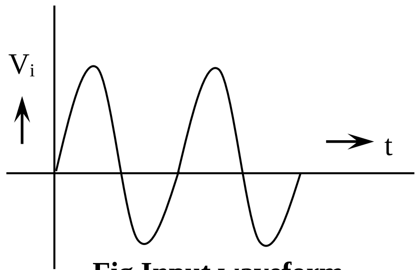


Fig Input waveform.

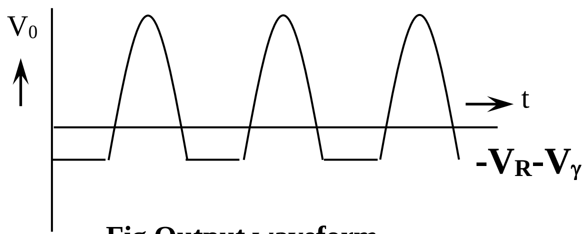


Fig Output waveform.

In this circuit, the diode gets forward biased for the input sinusoidal voltage is less than ($-V_R$). For input voltage greater than ($-V_R$), the diode is non-conducting and it is open. Then the output voltage is same as input voltage

VI. Negative Clipping with Positive Reference Voltage

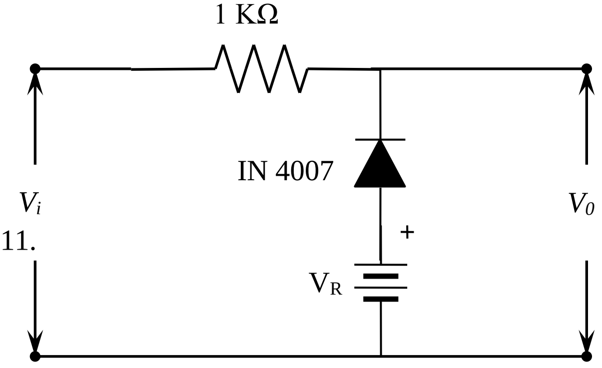
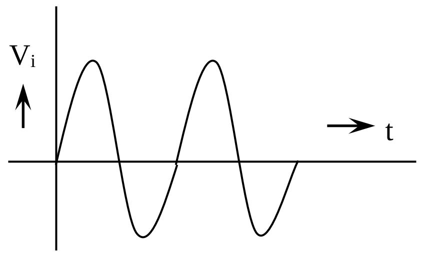


Figure:11.



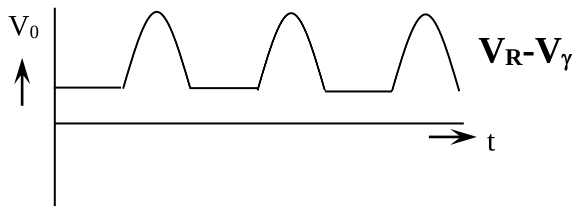


Fig: 12 Input waveform **Fig: 13Output waveform**.

For input sinusoidal signal voltage less than V_R, the diode is shorted and the output voltage is fixed ar V_R. For input sinusoidal voltage greater than V_R the diode is reverse biased and open circuited. Then the output voltage is same as input voltage.

VII. <u>Slicer</u>

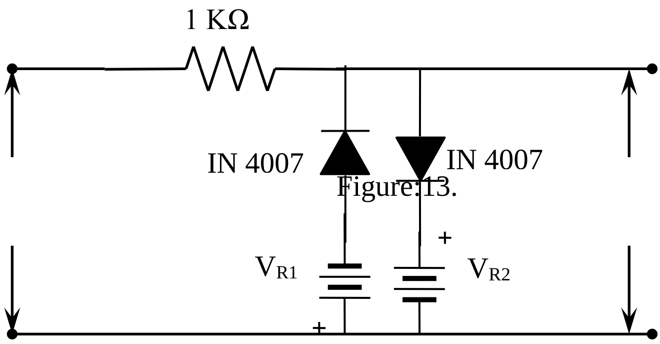


Figure:13.

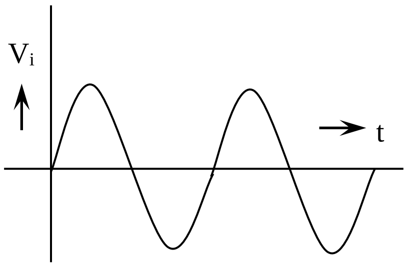


Fig: Input waveform

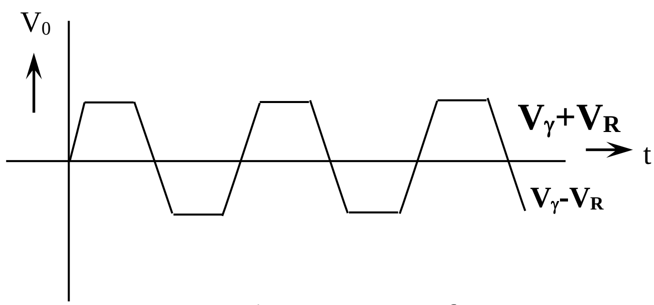


Fig Output waveform.

PROCEDURE:

1. Connect the circuit as shown in the figure 1.
2. Connect the function generator at the input terminals and CRO at the output
   a. terminals of the circuit.
3. Apply a sine wave signal of frequency 1KHz, Amplitude greater than the reference voltage at the input and observe the output waveforms of the circuits.
4. Repeat the procedure for figure 3, 5, 7, 9, 11 and 13

OBSERVATION TABLE:

S.No	Type of Clipping		$V_\gamma \pm V_R$	Theoretical Calculation Vclipped=Vin-Vout	Practical Calculation
1					
2					
3					

RESULT:

Theoretical and practical values of cut in voltage of diode and also made on theoretical and practical output wave forms for different reference

REAL TIME APPLICATIONS OF CLIPPER:

Clipping (Signal Processing) :

Clipping is a form of distortion that limits a signal once it exceeds a threshold. Clipping may occur when a signal is recorded by a sensor that has constraints on the range of data it can measure, it can occur when a signal is digitized, or it can occur any other time an analog or digital signal is transformed, particularly in the presence of gain or overshoot and undershoot.

Clipping photography:

In digital photography and digital video, clipping is a result of capturing or processing an image where the intensity in a certain area falls outside the minimum and maximum intensity which can be represented. It is an instance of signal clipping in the image domain. The clipped area of the image will typically appear as a uniform area of the minimum or maximum brightness, losing any image detail. The amount by which values were clipped, and the extent of the clipped area, affect the degree to which the clipping is visually noticeable or undesirable in the resulting image

VIVA QUESTIONS:

1. Define Non linear wave shaping?
2. Define clipping circuit?
3. What is piecewise linear mode of a diode?
4. What are the different types of clippers?
5. Which kind of a clipper is called a slicer circuit?
6. What are the disadvantages of the shunt clipper?
7. What are the disadvantages of the series clipper?
8. What considerations are taken into account while designing clipping circuits?
9. What is the influence of the practical diode compared to the ideal diode, in the above circuits?
10. If the input voltage magnitude is less than the reference voltages, then how the outputs look like?
11. Instead of sinusoidal wave form as input, if we give other wave forms like triangular then how the clipping action is performed?
12. What is a clipper? Describe (i) Positive clipper (ii) Biased clipper (iii) Combination clipper?
13. Discuss the differences between shunt and series clipper?
14. Define non linear wave shaping? What are the non-linear components?
15. Define clipping circuit? What are the other names for clippers?
16. Write the piecewise linear characteristics of a diode?
17. What are the different types of clippers?
18. What are the applications of Clipper Circuits?
19. What is the figure of merit for diodes used in clipping circuits?
20. What is the influence of the practical diode compared to the ideal diode, in the above circuits?
21. Instead of sinusoidal wave form as input, if we give other wave forms like triangular or square, then how the clipping action is performed?
22. What is $V\gamma$ for Ge diode and $V\gamma$ for Si diode?

23. What are the other names for the clippers?
24. Define linear wave shaping?
25. Define clipping circuit?
26. What is piecewise linear mode of a diode?
27. What are the different types of clippers?
28. What considerations are taken into account while designing shunt clipping circuits?
29. Instead of sinusoidal wave form as input, if we give other wave forms like square, then how the clipping action is performed?
30. What is a clipper? Describe (i) Positive clipper (ii) Biased clipper (iii) Combination clipper?
31. Discuss the differences between shunt and series clipper?

EXP 5

TYPES OF CLAMPERS AT DIFFERENT REFERENCE VOLTAGES

AIM:

To study the clamping circuits for different reference voltages and to verify the responses.

COMPONENTS REQUIRED:

1. Resistors - 1kΩ
2. IN4007 Diode
3. Capacitor -10μF

APPARATUS REQUIRED:

1. Bread board
2. Function generator (1Hz – 1Mz)
3. CRO (1Hz- 20MHz)
4. Power supply (0-30V)
5. Connecting Wires.

CIRCUIT DIAGRAM :

Negative Clamping Circuit

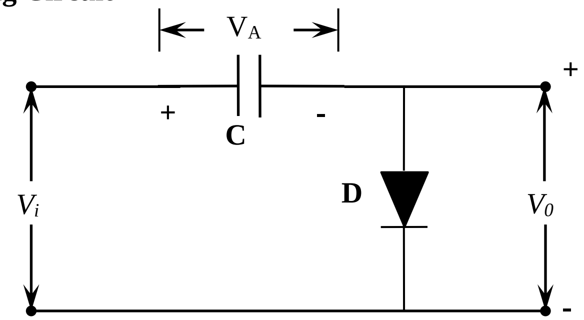


Fig: 1 Negative Clamping Circuit

Positive Clamping Circuit:

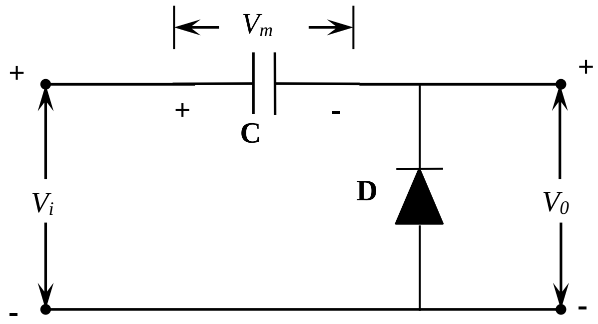


Fig: 2 Positive Clamping Circuit

Negative Clamping with Positive Reference Voltage

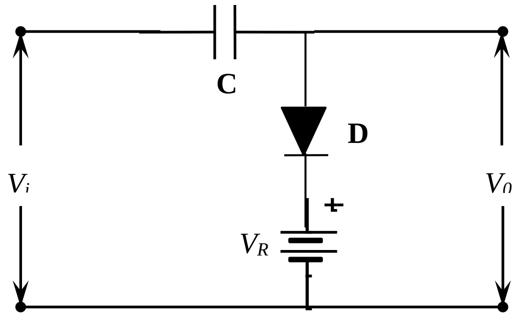
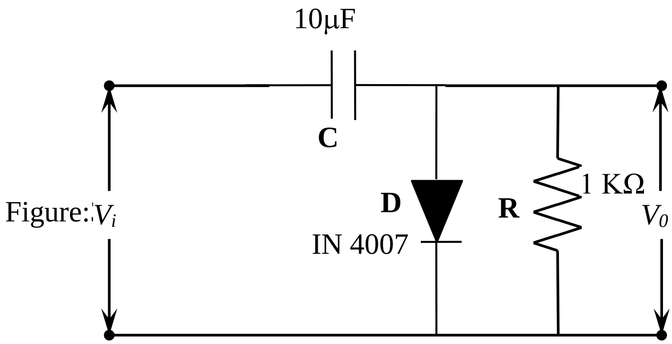
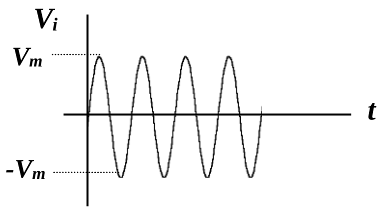


Fig: 3 Negative Clamping with Positive Reference Voltage

I. Negative Clamping





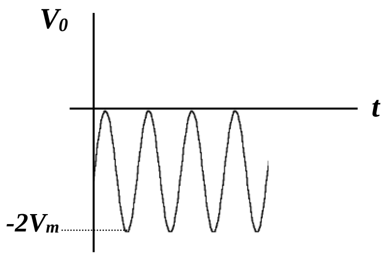
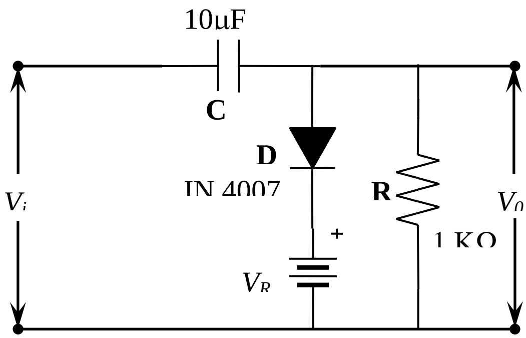
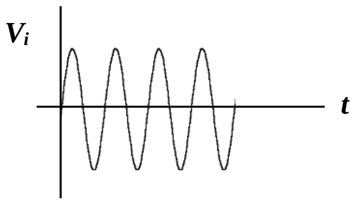


Fig:4 (a).Input waveform **Fig:4 (b) Output waveform.**

II. Negative Clamping with Positive Reference Voltage.





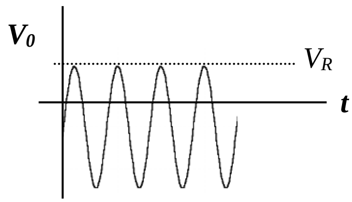
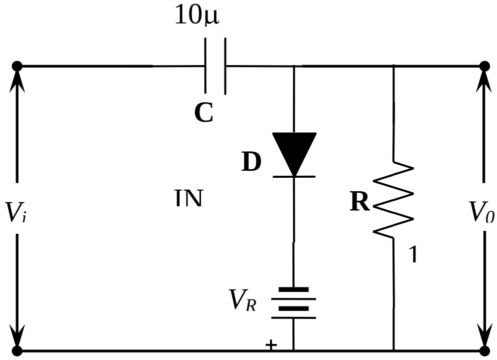
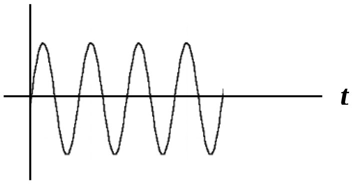


Fig: 5(a).Input waveform **Fig: 5 (b) Output waveform.**

III. Negative Clamping with Negative Reference Voltage.





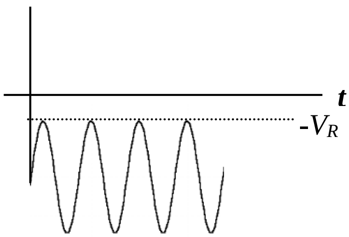
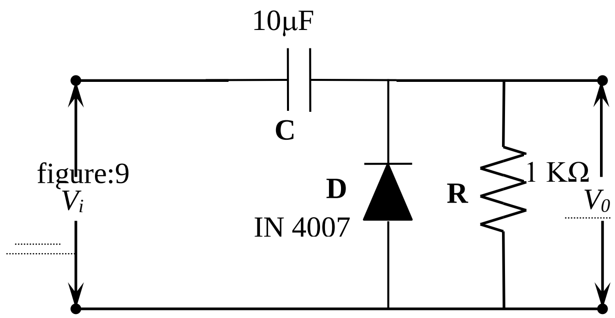
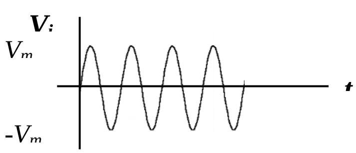


Fig: 6 (a).Input waveform **Fig: 6 (b) Output waveform.**

IV. Positive Clamping.





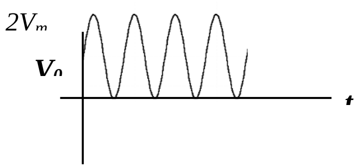


Fig: 7 (a).Input waveform **Fig: 7 (b) Output waveform**

V. Positive Clamping with Negative Reference Voltage.

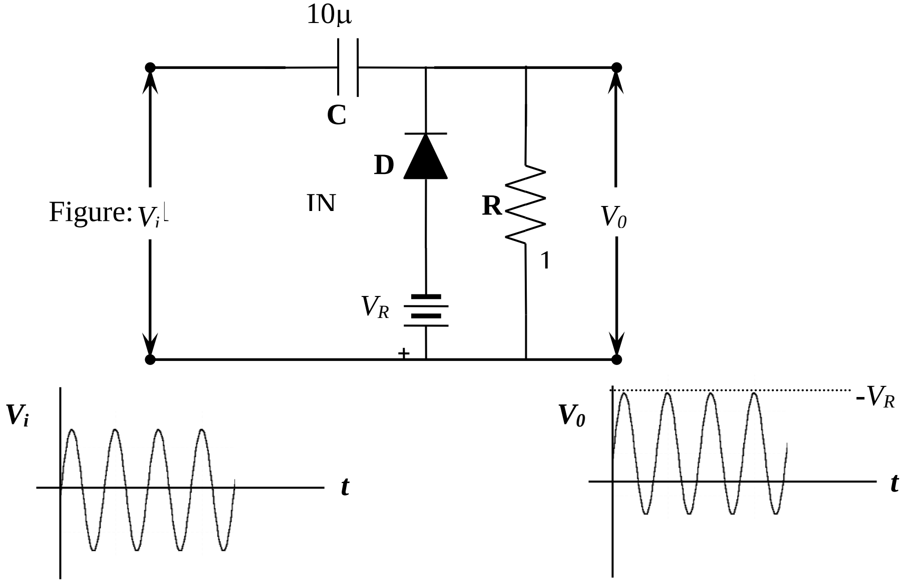


Fig: 8(a).Input waveform **Fig: 8(b) Output waveform**

VI. Positive Clamping with Positive reference Voltage.

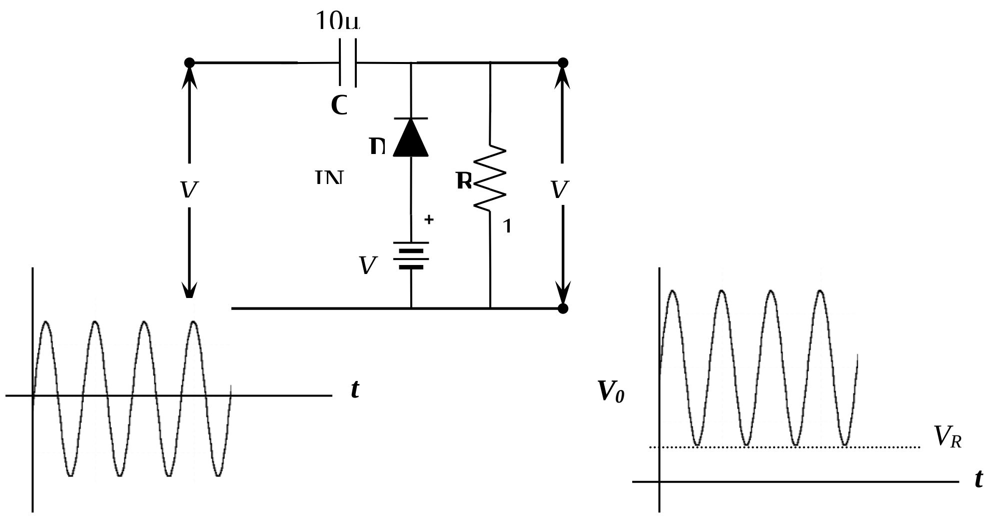


Fig: 9 (a).Input waveform **Fig: 9 (b) Output waveform**

OBSERVATION TABLE:

S.No	Type of Clamping	Vin	V_{ref}	Theoretical Calculation Vout=Vin±Vm	Practical Calculation
1					
2					

PROCEDURE:

1. Connect the circuit as shown in the figure 3.
2. Connect the function generator at the input terminals and CRO at the output terminals of the circuit.
3. Apply a sine wave greater than the reference voltage, and signal of frequency 1kHz at the input and observe the output waveforms of the circuits in CRO.
4. Repeat the above procedure for the different circuit diagram as shown inf figure 5, 7, 9, 11 and 13.

RESULT:

Theoretical and practical values of cutin voltages of diode and also theoretical and practical output wave forms for different reference voltages are studied

VIVA QUESTIONS:

1. What are the applications of clamping circuits?
2. What is the synchronized clamping?
3. Explain the Principle of operation of Clampers.
4. What is clamping circuit theorem.
5. What is the function of capacitor in clamper circuit?
6. What are the effects of diode characteristics on the output of the Clamper?
7. If we interchange the diode and the capacitor in fig 1 above, how the circuit behaves?

8. What is floating output and grounded output for a DC power supply? If we use grounded output PS in the above circuits, what will happen?
9. Calculate the power dissipation in the Resistor for any one of the above circuits?
10. What is the difference between a clipper and a clamper?
11. 1. Explain the operation of a clamping circuit for a square wave input?
12. Differentiate the clippers with clampers?
13. Give the applications of clampers?
14. What are the applications of clamping circuits?
15. What is the synchronized clamping?
16. What is a clamper?
17. Explain the Principle of operation of Clampers?
18. What is clamping circuit theorem.
19. What is the function of capacitor in clamper circuit?
20. What are the effects of diode characteristics on the output of the Clamper?
21. If we interchange the diode and the capacitor in fig 1 above, how the circuit behaves?
22. Calculate the power dissipation in the Resistor for any one of the above circuits?
23. What is the difference between a clipper and a clamper?
24. . What are the other names for clampers?
25. Give some practical applications of clamper?
26. What is the purpose of shunt resistance in clamper?
27. What is used for clamper?
28. What is purpose of clampers?
29. What is mean by clamper?
30. Explain the principle of operation of clampers.

REAL TIME APPLICATIONS OF CLAMPER CIRCUITS

Clampers in electronics are widely used in the operation of analog television receivers and FM transmitters. The variable-frequency interference can be removed by using the clamping method in television receivers, and in FM transmitters

EXPT NO: 6

INPUT & OUTPUT CHARACTERISTICS OF A BJT IN CE,CB,CC CONFIGURATION

EXP -6A

INPUT & OUTPUT CHARACTERISTICS OF A BJT IN COMMON EMITTER (CE) CONFIGURATION

A*IM*: -

1. To study the input and output characteristics of transistor (BJT) connected in common Emitter configuration.
2. To calculate current gain β.
3. To calculate input resistance Ri & output resistance Ro.

EQUIPMENTS & COMPONENTS REQUIRED:

S.No	Device	Range/Rating	Qty
1.	Regulated DC supply voltage (RPS)	0-30V	1
2.	Voltmeter	0-1V or 0-10v,0-20V	1
3.	Ammeter	0-10mA,200mA	1
4.	Connecting wires & bread board		
5	Transistor BC 107 or 2n2222 or BC547	NPN	1
6	Resistor	1K,100K	1

THEORY:

A transistor is a three-terminal device. The terminals are emitter, base, collector. In common emitter configuration, input voltage is applied between base and emitter terminals and output is taken across the collector and emitter terminals. Therefore, the emitter terminal is common to both input and output. The input characteristics resemble that of a forward biased diode curve. This is expected since the Base-Emitter junction of the transistor is forward biased. As compared to CB arrangement IB increases less rapidly with VBE. Therefore, input resistance of CE circuit is higher than that of CB circuit. The output characteristics are drawn between Ic and VCE at constant IB. the collector current varies with VCE unto few volts only. After this the collector current becomes almost constant, and independent of VCE. The value of VCE up to which the collector current changes with V CE is known as Knee voltage. The transistor always operated in the region above Knee voltage, IC is always constant and is approximately equal to IB.

The current amplification factor of CE configuration is given byB = ΔIC/ΔIB

CIRCUIT DIAGRAM:

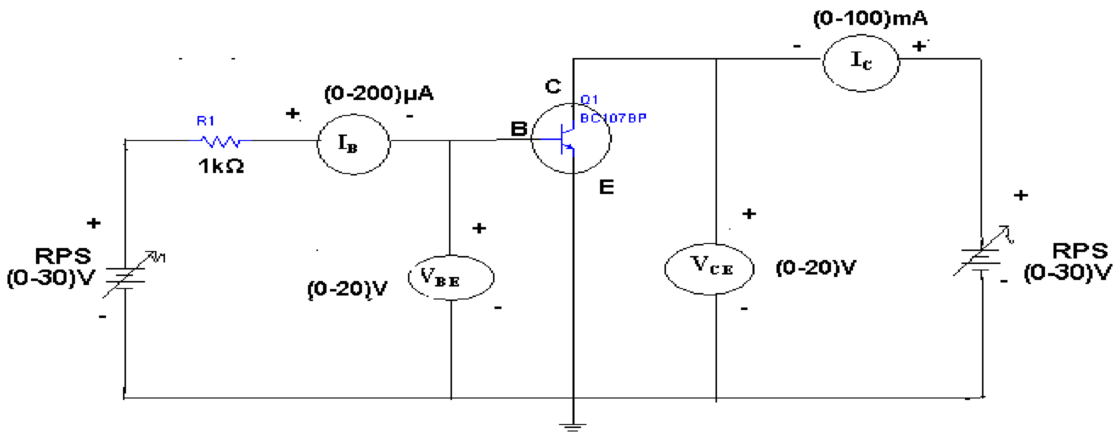


Fig 1 Input and Output Characteristics of a CE

PROCEDURE: -

Input characteristics:

1. Connect the circuit according to the circuit diagram of input characteristics
2. Keep (Collector to Emitter Voltage) VCE=0V) by varying VCC (collector supply voltage). Increasing VBB (Base supply Voltage from 0 onwards (0.1V, 0.2V….0.75V) observe IB (Base current) for different values of VBE (Base to Emitter voltage).
3. Repeat the Step 2 for Different (collector to Emitter voltage) VCE i.e. 3V & 6V.
4. Tabulate the results in the tabular form and plot the graph.

Output characteristics:

1. Connect the circuit according to the circuit diagram of output characteristic.
2. Keep (collector supply voltage) VCC=0V. Increase (Base supply Voltage) VBB to get Base current IB= 3µA.
3. Now increase (Collector supply voltage) VCC from 0 onwards and observe the Collector current IC for different Values of (Collector to Emitter voltage) VCE Without exeding the rated value (IC=15mA)
4. Tabulate the results in the tabular coloum and plot the graph

OBSERVATIONS:

INPUT CHARACTERISTICS:

S.NO	V_{CE} = 1V		V_{CE} = 2V		V_{CE} = 4V	
	V_{BE}(V)	I_B(µA)	V_{BE}(V)	I_B(µA)	V_{BE}(V)	I_B(µA)

OUT PUT CHARACTERISTICS:

S.NO	I_B = 5Ma		I_B = 10Ma		I_B = 15 Ma	
	V_{CE}(V)	I_C(mA)	V_{CE}(V)	I_CmA)	V_{CE}(V)	I_C(mA)

EXPECTED GRAPHS:

INPUT CHARACTERSTICS:

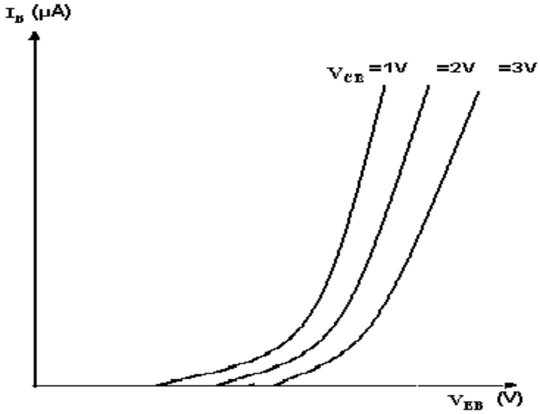


Fig 2 Input Characteristics of a CE

OUTPUT CHARECTERSTICS:

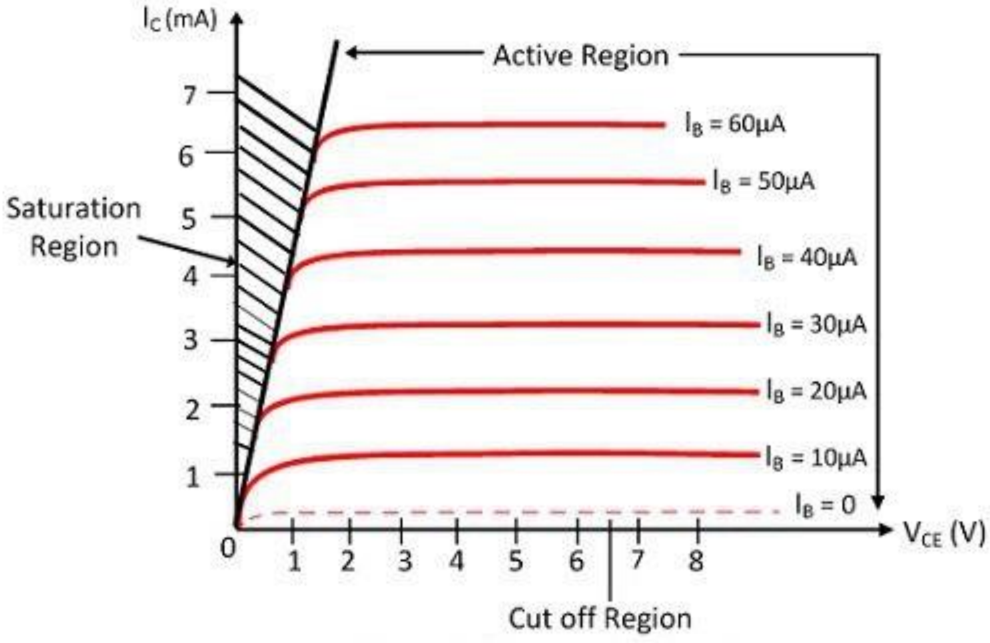


Fig 3 Output Characteristics of a CE configuration

RESULTS:

The input and output characteristics of CE are observed

REALTIME APPLICATIONS:

Common-emitter amplifiers are also used in radio frequency circuits, for example to amplify faint signals received by an antenna. In this case it is common to replace the load resistor with a tuned circuit. This may be done to limit the bandwidth to a narrow band centered around the intended operating frequency. More importantly it also allows the circuit to operate at higher frequencies as the tuned circuit can be used to resonate any inter-electrode and stray capacitances, which normally limit the frequency response. Common emitters are also commonly used as low-noise amplifiers.

Viva questions

1. What is Common emitter configuration?
2. What is the range of β for the transistor?
3. What are the input and output impedances of CC configuration?
4. Identify various regions in the output characteristics?
5. What is the relation between α ,β and γ ?
6. Define Cutoff ,Active and Saturation region?
7. Define current gain in CE configuration?
8. Why CE configuration is preferred for amplification?
9. What is the phase relation between input and output?
10. Draw diagram of CE configuration for PNP transistor?
11. What is the power gain of CE configuration?
12. What are the applications of CE configuration?

EXP -6B
INPUT & OUTPUT CHARACTERISTICS OF A BJT IN COMMON BASE (CB) CONFIGURATION

AIM: -

1. To study the input and output characteristics of transistor (BJT) connected in common
   Base configuration.
2. To calculate current gain α.
3. To calculate input resistance Ri & output resistance Ro.

EQUIPMENTS & COMPONENTS REQUIRED:

S.No	Device	Range/Rating	Qty
1.	Regulated DC supply voltage(RPS)	0-30V	1
2.	Voltmeter	0-1Vor 0-10v ,0-20V	2
3.	Ammeter	0-10mA,200mA	2
4.	Connecting wires & bread board		
5	Transistor BC 107 or 2n2222 or BC547	NPN	1
6	Resistor	1K,10K	1

THEORY: -

The name transistor is derived from TRANSFER RESISTOR. [A transistor transfers a signal level of resistance to another level of resistance

A transistor is a three terminal active device. The terminals are emitter, base, collector. In CB configuration, the base is common to both inputs (emitter) and output (collector). For normal operation, the E-B junction is forward biased and C-B junction is reverse biased. There are two types of transistors made of either Ge or Si

i. NPN transistor.
ii. PNP transistor.

- Common Base Configuration
- Common Emitter Configuration
- Common Collector Configuration

In common base configuration, input is applied between emitter and base & output is taken from collector and base as shown in fig.

CHARACTERISTICS OF A COMMON BASE CONFIGURATION: -

The complete electrical behaviour of a transistor can be described by specifying the interrelation of the various currents and voltages. The most important characteristics are input and output characteristics

INPUT CHARACTERISTIC: It is given by the graph between emitter current I_E and emitter-base voltage V_{EB} at constant collector – base voltage $V_{CB.}$

Input resistance, $r_i = \Delta VEB / \Delta I_E$ at a constant V_{CB}

OUTPUT CHARACTERISTIC: It is the graph between collector current I_C and collector base voltage V_{CB} at constant emitter current I_E

output resistance, $r_0 = \Delta V_{CB} / \Delta Ic$ at constant I_E

PROPERTIES:

i) Input resistance is small (10 Ω- 100 Ω)
ii) Output resistance is high (1 M Ω)
iii) Current amplification factor $\alpha = \Delta Ic / \Delta Ib$ at constant V_{CB} (current gain) is low
iv) Highest voltage gainΔ
v) Moderate power gain
vi) CB amplifier can be designed without self bias circuit

APPLICATIONS:

i. To provide voltage gain without any current gain
ii. For impedance matching in high frequency applications

DISADVANTAGES:

Because of low input resistance loading effects are high.

CIRCUIT DIAGRAM:

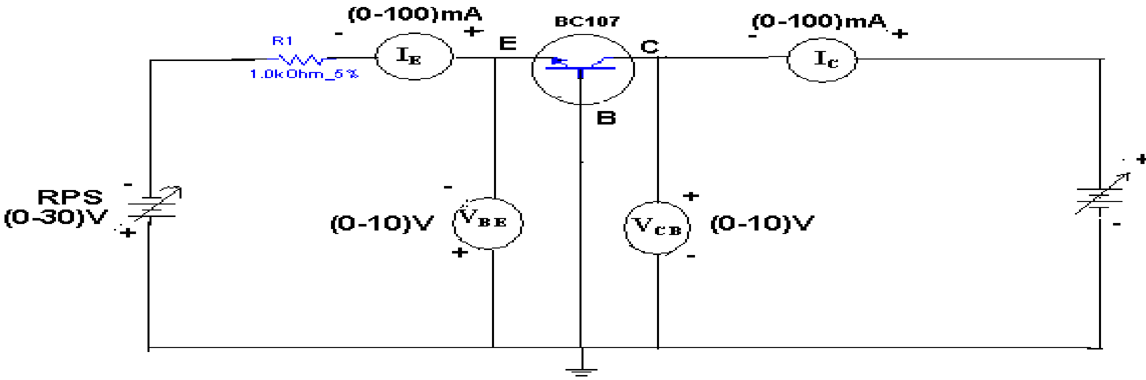


Fig 1: Input and Output Characteristics of a Common Base Configuration

PROCEDURE: -

Input characteristics:

1. Connect the circuit according to the circuit diagram of input characteristics
2. Keep (Collector to Base Voltage) VCB=0V) by varying VCC (collector supply voltage). Increasing VEE (Emitter supply Voltage from 0 onwards (0.1V, 0.2V….0.75V) observe IE (Emitter current for different values of VEB (Emitter to Base voltage).
3. Repeat the Step 2 for Different (collector to Base voltage) VCB i.e. 3V & 6V.
4. Tabulate the results in the tabular coloum and plot the graph.

Output characteristics:

1. Connect the circuit according to the circuit diagram of output characterists.
2. Keep (collector supply voltage) VCC=0V. Increase (Emitter supply Voltage) VEE to get Emitter current IE= 3mA.
3. Now increase (Collector supply voltage) VCC from 0 onwards and observe the Collector current IC for different Values of (Collector to Base voltage) VCB Without exeding the rated value (IC=15mA)
4. Tabulate the results in the tabular column and plot the graph.

OBSERVATIONS:

INPUT CHARACTERISTICS:

S.No	V_{CB}=0V		V_{CB}=1V		V_{CB}=2V	
	V_{EB}(V)	I_E(mA)	V_{EB}(V)	I_E(mA)	V_{EB}(V)	I_E(mA)

OUTPUT CHARACTERISTICS:

S.No	I_E=10mA		I_E=20mA		I_E=30mA	
	V_{CB}(V)	I_C(mA)	V_{CB}(V)	I_C(mA)	V_{CB}(V)	I_C(mA)

EXPECTED GRAPHS:

INPUT CHARACTERISTICS

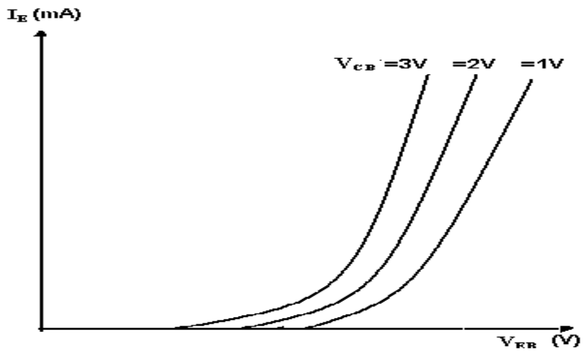
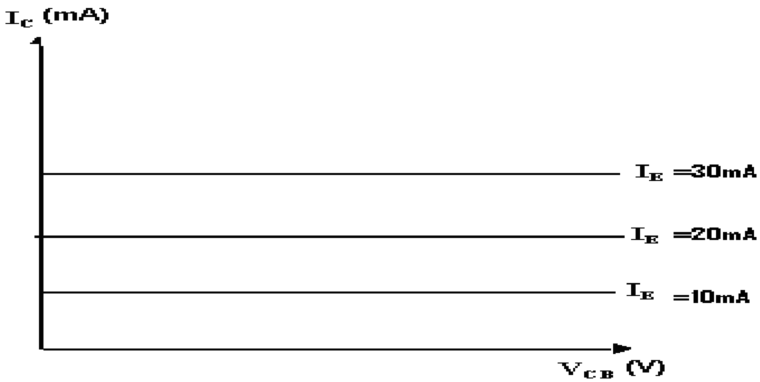


Fig 2 Input Characteristics of Common Base Configuration

OUTPUT CHARACTERISTICS



6.3 Output Characteristics of Common Base Configuration

PRECAUTIONS:

1. Always keep the supply Voltage Knobs i.e. VEB, VCB positions at minimum position when switching on & off .
2. Never load the meters above its rated range.
3. Avoid loose connections at the junction.

RESULT*:* -

The input and ouput characteristics of CB are observed.

Viva Questions

1.What is Common Base Configuration?
2.What are the characteristics of CB ?
3. What is transistor and why it is called like that?
4.Define **α?**
5. What is the range of α for the transistor?
6. What are the input and output impedances of CB configuration?
7. Identify various regions in the output characteristics?
8. What is the relation between α ,β
9. Define current gain in CB configuration?
10. Why CE configuration is preferred for amplification?
11. What is the phase relation between input and output in CB configuration?
12. What is the power gain of CB configuration?
13. What are the applications of CB configuration?
14.What is Early Effect?
15.Define voltage gain in CB configuration

EXP -6C

INPUT & OUTPUT CHARACTERISTICS OF A BJT IN COMMON COLLECTOR (CC) CONFIGURATION

AIM: -

1. To study the input and output characteristics of transistor (BJT) connected in common collector configuration.
2. To calculate current gain γ .
3. To calculate input resistance Ri & output resistance Ro.

EQUIPMENTS & COMPONENTS REQUIRED:

S.No	Device	Range/Rating	Qty
1.	Regulated DC supply voltage(RPS)	0-30V	1
2.	Voltmeter	0-1Vor 0-10v ,0-20V	2
3.	Ammeter	0-10mA,200mA	2
4.	Connecting wires & bread board		
5	Transistor BC 107 or 2n2222 or BC547	NPN	1
6	Resistor	1K,10K	1

THEORY: -

The name transistor is derived from TRANSFER RESISTOR. [A transistor transfers a signal level of resistance to another level of resistance

A transistor is a three terminal active device. The terminals are emitter, base, collector. In CB configuration, the base is common to both inputs (emitter) and output (collector). For normal operation, the E-B junction is forward biased and C-B junction is reverse biased. There are two types of transistors made of either Ge or Si

iii. NPN transistor.

iv. PNP transistor.

NPN and PNP transistors are called Complementary transistors

A transistor can be connected in a circuit in the following three ways depending on which terminal is common to input and output.

- Common Base Configuration
- Common Emitter Configuration
- Common Collector Configuration

In common base configuration, input is applied between emitter and base & output is taken from collector and base as shown in fig.

CHARACTERISTICS OF A COMMON COLLECTOR CONFIGURATION: -

The complete electrical behavior of a transistor can be described by specifying the interrelation of the various currents and voltages. The most important characteristics are input and output characteristics

INPUT CHARACTERISTIC: It is given by the graph between emitter current I_E and emitter-base voltage V_{EB} at constant collector – base voltage $V_{CB.}$

Input resistance, $r_i = \Delta VEB / \Delta I_E$ at a constant V_{CB}

OUTPUT CHARACTERISTIC: It is the graph between collector current I_C and collector base voltage V_{CB} at constant emitter current I_E

output resistance, $r_0 = \Delta V_{CB} / \Delta Ic$ at constant I_E

PROPERTIES:

vii) Input resistance is small (10 Ω- 100 Ω)

viii) Output resistance is high (1 M Ω)

ix) Current amplification factor $\alpha = \frac{D\ I_C}{D\ I_E}$ at constant V_{CB} (current gain) is low

x) Highest voltage gain

xi) Moderate power gain

xii) CB amplifier can be designed without self bias circuit

APPLICATIONS:

iii. To provide voltage gain without any current gain

iv. For impedance matching in high frequency applications

DISADVANTAGES:

Because of low input resistance loading effects are high.

CIRCUIT DIAGRAM:

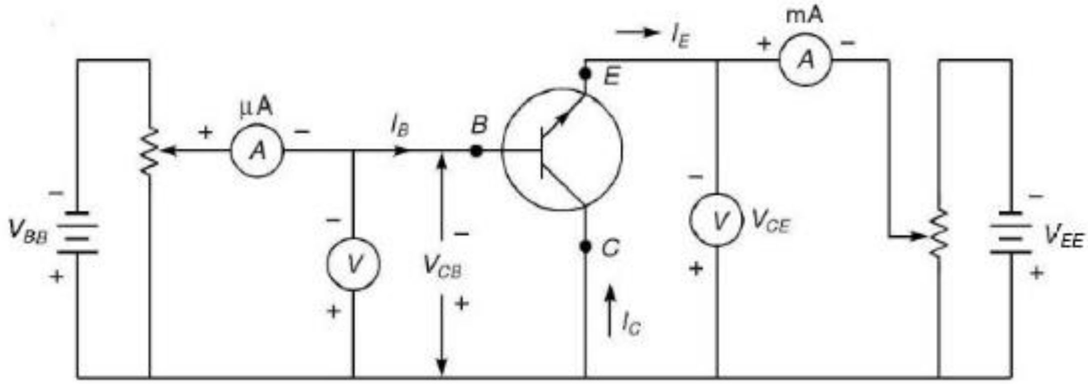


Fig 1 :Input and Output Characteristics of a Common Collector Configuration

PROCEDURE: -

Input characteristics:

1.Connect the circuit according to the circuit diagram of input characteristics

2.Keep (Collector to Base Voltage) VEC=0V) by varying VBB (Base supply voltage).

3.Increasing VBC (Emitter supply Voltage from 0 onwards (0.1V, 0.2V….0.75V) observe IB (base current for different values of VEB (Emitter to Base voltage).

4. Repeat the Step 2 for Different VEC i.e. 3V & 6V.

5. Tabulate the results in the tabular Coolum and plot the graph.

Output characteristics:

1.Connect the circuit according to the circuit diagram of input characteristics

2.Keep IB=0V) by varying VEE (Base supply voltage).

3.Increasing VEE (Emitter supply Voltage from 0 onwards (0.1V, 0.2V….0.75V) observe IE (emmiter current for different values of VEC (Emitter to Collector voltage).

4. Repeat the Step 2 for Different VEC i.e. 3V & 6V.

5. Tabulate the results in the tabular coloum and plot the graph.

OBSERVATIONS:

INPUT CHARACTERISTICS:

S.No	V_{EC}=0V		V_{EC}=1V		V_{EC}=2V	
	V_{BC}(V)	I_B(mA)	V_{BC}(V)	I_B(mA)	V_{BC}(V)	I_B(mA)

OUTPUT CHARACTERISTICS:

S.No	I_B=10mA		I_B=20mA		I_B=30Ma	
	V_{EC}(V)	I_E(mA)	V_{EC}(V)	I_E(mA)	V_{EC}(V)	I_E(mA)

EXPECTED GRAPHS

INPUT CHARACTERISTICS

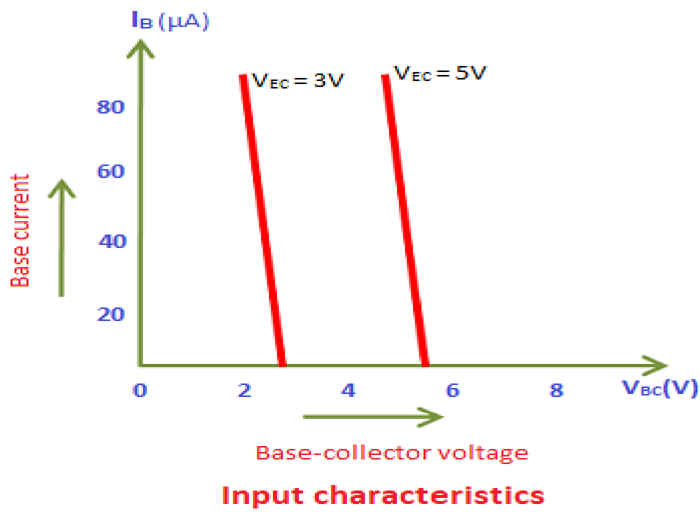
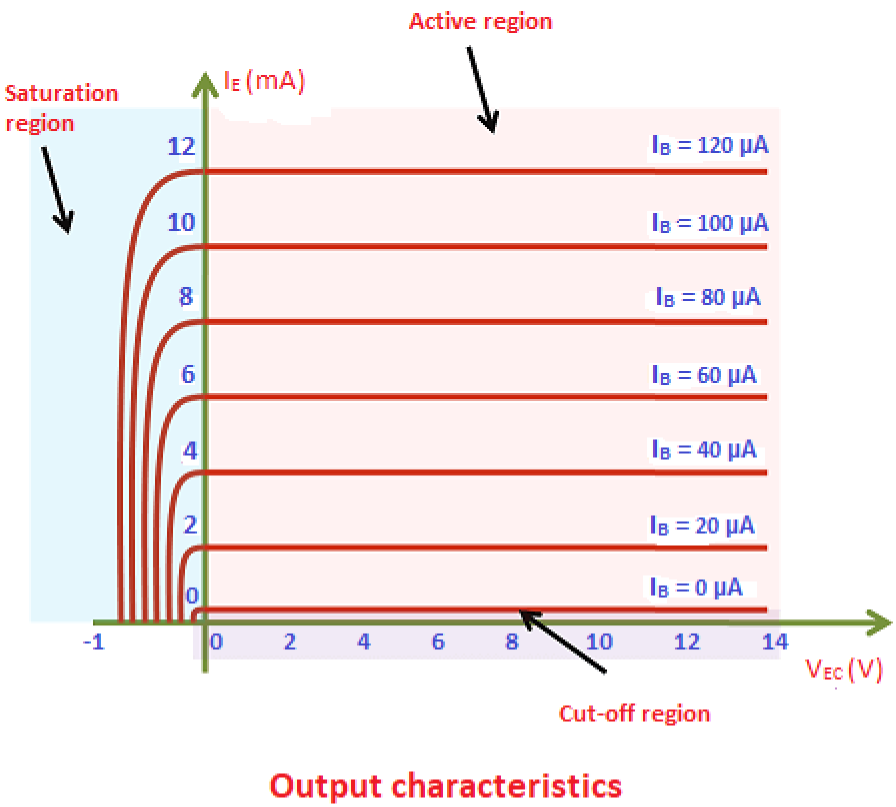


Fig 2 Input Characteristics of Common Collector Configuration

OUTPUT CHARACTERISTICS



3 Output Characteristics of Common Collector Configuration

PRECAUTIONS:

1. Always keep the supply Voltage Knobs i.e. VEB, VCB positions at minimum position when switching on & off .
2. Never load the meters above its rated range.
3. Avoid loose connections at the junction.

RESULT: -
The input and output characteristics of CB are observed

VIVA QUESTIONS

1. What are the applications of CC configuration? . What is the range of γ for the transistor?
2. What are the input and output impedances of CC configuration?
3. Identify various regions in the output characteristics?
4. What is the relation between β and γ ??
5. Define current gain in CC configuration?
6. Why CE configuration is preferred for amplification?
7. What is the phase relation between input and output?
8. Draw diagram of CC configuration for PNP transistor?
9. What is the power gain of CC configuration?
10. What are the applications of CC configuration?
11. What is the relation between α ,β and γ ?
12. Why the doping of collector is less compared to emitter?
13. What is the difference between CE and Emitter follower circuit?
14. What are the input and output impedances of CC configuration?
15. Compare CE,CC,and CB configuration?
16. List the applications of CC Configuration?

mode?

17.Why BJT is called Current Controlled device?

EXPT NO: 7

LOGIC GATES USING BJT

AIM:

To Implement Logic gates using BJT

EQUIPMENTS & COMPONENTS REQUIRED:

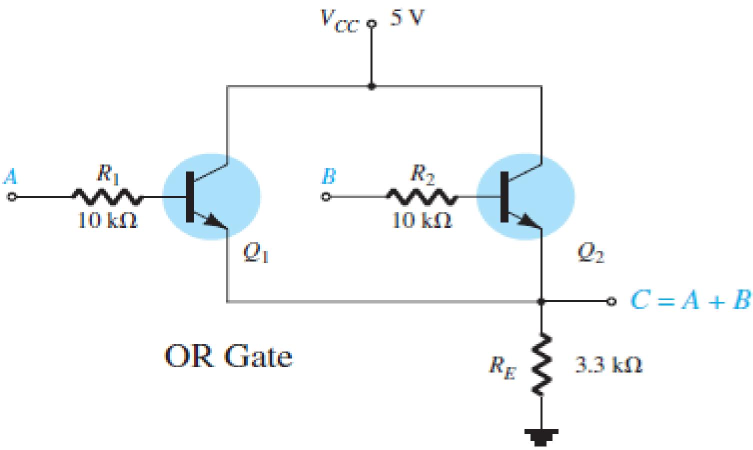
S.No	Device	Range/Rating	Qty
1.	Resistors	1K,4.7K	2
2.	Silicon diodes	1N914/1N4148	2
3	D.C. Power supply	5V	1
4	LED		2
5	Connecting wires		6
6	Breadboard		1

Theory:

If both *A* and *B* of the OR gate of Fighave a low or 0-V input, both transistors are off (cutoff), and the impedance between the collector and the emitter of each transistor can be approximated by an open circuit. Mentally replacing both transistors by open circuits between the collector and the emitter will remove any connection between the applied bias of 5 V and the output. The result is zero current through each transistor and through the 3.3- k_ resistor. The output voltage is therefore 0 V, or “low”—a 0 state. On the other hand, if transistor *Q* 1 is on and *Q* 2 is off due to a positive voltage at the base of *Q* 1 and 0 V at the base of *Q*2, then the short-circuit equivalent between the collector and emitter for transistor *Q* 1 can be applied, and the voltage at the output is 5 V, or “high”—a 1 state. Finally, if both transistors are turned on by a positive voltage applied to the base of each, they will both ensure that the output voltage is 5 V, or “high”—a 1 state. The operation of the OR gate is properly defined: an output if either input terminal has applied turn-on voltage or if both are in the “on” state. A 0 state exists only if both do not have a 1 state at the input terminals.

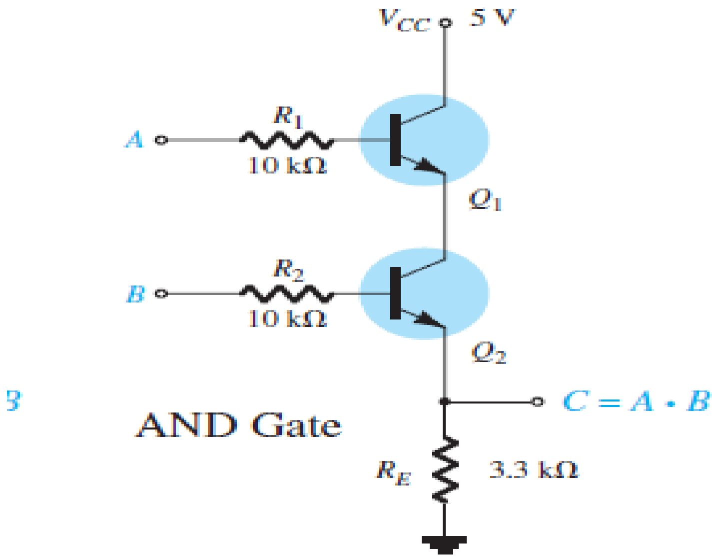
The AND gate of Figrequires that the output be high only if both inputs have a turn-on voltage applied. If both are in the “on” state, a short-circuit equivalent can be used for the connection between the collector and the emitter of each transistor, providing a direct path from the applied 5-V source to the output—thereby establishing a high, or 1, state at the output terminal. If one or both transistors are off due to 0 V at the input terminal, an open circuit is placed in series with the path from the 5-V supply voltage to the output, and the output voltage is 0 V, or an “off” state.

CIRCUIT DIAGRAM



OR Gate

Input		Output Q = A+B
A	B	
0	0	
0	1	
1	0	
1	1	



Input		Output
A	B	Q = A.B
0	0	
0	1	
1	0	
1	1	

PROCEDURE: -

1. Connect the circuit according to the circuit diagram as shown in figure on breadboard.
2. Give input at pin & take output
3. Note the values of output fo r different combination of inputs & draw the truth table.

RESULT:
Implementation of logic gates using transistors is observed

Viva Questions

1. When a BJT is used in a logic gate it?
2. What is the purpose of a BJT?
3. Why we use transistors in logic gate?
4. Why logic gate is so called?
5. Difference between a gate AND a circuit?
6. What are the applications of gates?
7. Why are logic gates important?
8. What are the basic logic gates?
9. Why are the NAND and NOR gates called digital building blocks?
10. NOT gates is called inverter, why?

EXP NO:8

TRANSISTOR AS A SWITCH

AIM:

Design Transistor to act as a Switch and verify the operation.

APPARATUS:

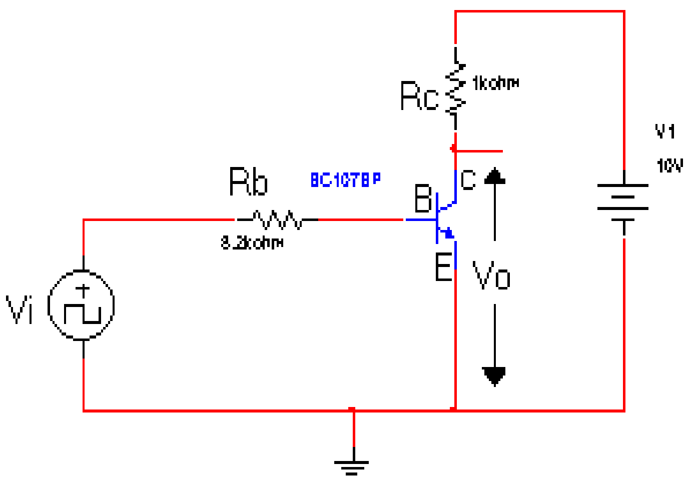
1. Transistor (BC 107).
2. Breadboard.
3. LED.
4. Resistors (1KΩ, 8.2KΩ).
5. DC power supply.
6. Connecting patch cards.

THEORY:

When the I/P voltage V_i is negative or zero, transistor is cut-off and no current flows through $R_c$hence $V_0 \cong V_{CC}$ when I/P Voltage V_i jumps to positive voltage, transistor will be driven into saturation. Then

$$V_0 = V_{cc} - I_C R_C \cong V_{CESat}$$

CIRCUIT DIAGRAM:



OBSERVATION TABLE:

Vi	Vbe	Vce	Output
1			
2			

PROCEDURE:

1. Connect the circuit as shown in figure.
2. By changing the DC input from 0 to 5V observe Vbe and Vce values along with LED output.
3. Tabulate Vbe and Vce Values.

RESULT:

Transistor as a switch has been designed and Output is observed.

REAL TIME APPLICATIONS:

Applications of Bipolar Junction Transistor:

There are two types of **applications of bipolar junction transistor**, switching and amplification.

Transistor as a Switch

For switching applications transistor is biased to operate in the saturation or cutoff region. Transistor in cutoff region will act as an open switching whereas in saturation will act as a closed switch.

Viva Questions

1.Differentiate Diode and Transistor as a switch?

2.Mention typical values of V_{BE} Sat, V_{CE} Sat for both Si, Ge Transistors?

3.Define ON time and OFF time of the transistor?

4.In which regions Transistor acts as a

5.Explain phenomenon of "latching "in a Transistor switch?

6.Define Rise time & fall time of a transistor switch?

7.Define Storage time?

8.Define delay time?

9.What is the phase difference between the input waveform and the output waveform, when the transistor is conducting?

10.What modifications are to be done in the above circuit if we use PNP transistor instead of NPN transistor?

EXP NO:9

VOLTAGE LEVEL INDICATOR

AIM: To Indicate voltage level using BJT.

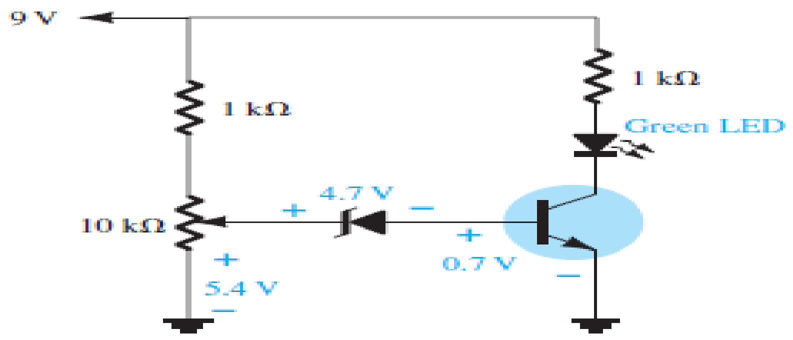
CIRCUIT DIAGRAM

S.No	Device	Range/Rating	Qty
1.	Resistors	1K,10K	3
2.	Silicon diode/Zener diode	1N914/1N4148	2
3	D.C. Power supply	5V	1
4	LED		2
5	Connecting wires		6
6	Breadboard		1

Theory:

The voltage level indicator, includes three of the elements introduced thus far: the transistor, the Zener diode, and the LED. The voltage level indicator is a relatively simple network using a green LED to indicate when the source voltage is close to its monitoring level of 9 V. In Fig. the potentiometer is set to establish 5.4 V at the point indicated. The result is sufficient voltage to turn on both the 4.7-V Zener and the transistor and establish a collector current through the LED sufficient in magnitude to turn on the green LED. Once the potentiometer is set, the LED will emit its green light as long as the supply voltage is near 9 V. However, if the terminal voltage of the 9-V battery should decrease, the voltage set up by the voltage-divider network may drop to 5 V from 5.4 V. At 5 V there is insufficient voltage to turn on both the Zener and the transistor, and the transistor will be in the “off” state. The LED will immediately turn off, revealing that the supply voltage has dropped below 9 V or that the power source has been disconnected.

CIRCUIT DIAGRAM



PROCEDURE: -

1. Connect the circuit according to the circuit diagram as shown in figure on breadboard.
2. By varying RPS observe the LED output.
3. At 4.7 V RPS Supply the LED will be turn on and it indicates that the operating voltage of zener diode is 4.7 V.

RESULT: The voltage level indicator is observed.

REAL TIME APPLICATIONS:

The voltage level indication is used to measure the output voltages of different electronic devices.

Viva Questions

1. What are the applications of BATTERY LEVEL INDICATOR?
2. What is a Voltage Level Indicator?
3. How do High Voltage Level Indicator works?
4. How do you use a battery voltage indicator?
5. What is Battery voltage sensor?
6. What is the importance of battery indicator?
7. What are the three types of Charge indicators used in Vehicles?

EXP : 10
COMMON EMITTER AMPLIFIER AND COMMON COLLECTOR AMPLIFIER CHARACTERISTICS

EXP-10 A
COMMON EMITTER AMPLIFIER CHARACTERISTICS

AIM: -

To plot frequency response of CE amplifier and calculate gain & bandwidth.

EQUIPMENTS & COMPONENTS REQUIRED:

S.No	Device	Range/Rating	Qty
1.	(a) Regulated DC supply voltage	0-30V	1
2	Function generator	1MHz	1
2.	Dual trace CRO(oscilloscope)	25MHz	1
3.	BJT	BC107	1
4.	Connecting wires		
5.	Capacitor	10μf=2,100 μf	
6.	Resistor	220.Ω,5.6kΩ,22K,1K,10K	

THEORY:

The CE amplifier provides high gain & wide frequency response. In this amplifier the emitter lead is common to both input & output circuits and is grounded. The emitter-base circuit is forward biased. The collector current is controlled by the base current rather than emitter current. The input signal is applied to base terminal of the transistor and amplifier output is taken across collector terminal. A very small change in base current produces a much larger change in collector current. When +VE half-cycle is fed to the input circuit, it opposes the forward bias of the circuit which causes the collector current to decrease, it decreases the voltage more –VE. Thus when input cycle varies through a -VE half-cycle, increases the forward bias of the circuit, which causes the collector current to increases thus the output signal is common emitter amplifier is in out of phase with the input signal.

CIRCUIT DIAGRAM:

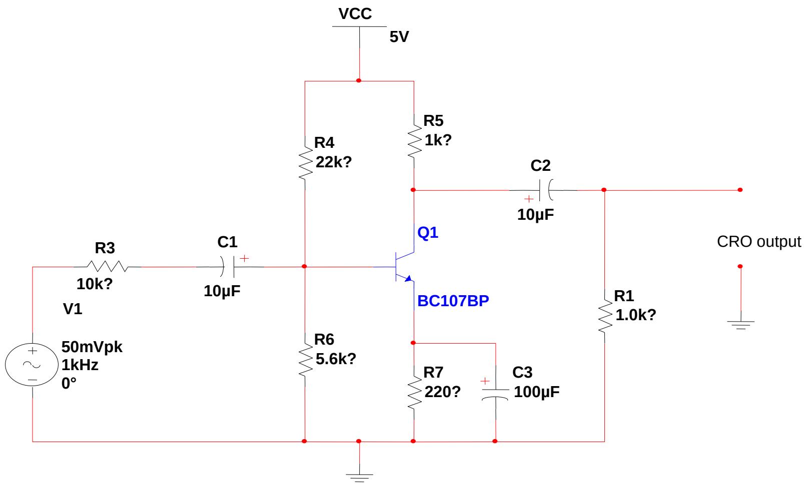


Fig 1 Common Emitter Amplifier Characteristics

PROCEDURE: -

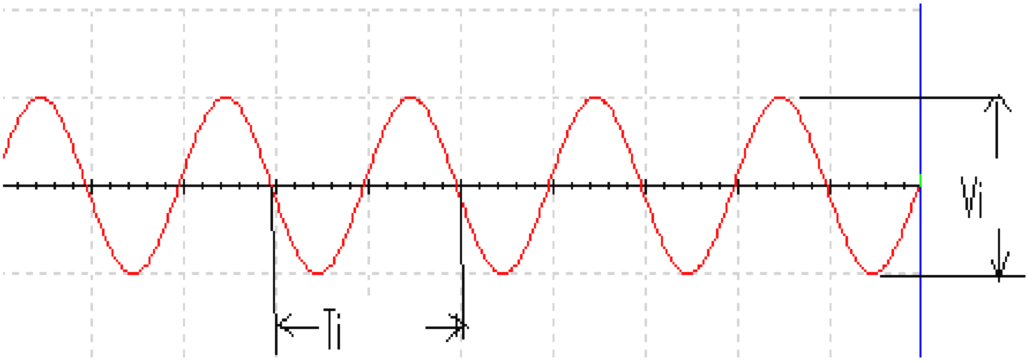
1. Connect the circuit according to the circuit diagram as shown in figure on breadboard.
2. Set the power supply at 12V and function generator signal amplitude (20 to 50mV) for (sine wave) 1 KHz frequency on CH-1knob to minimum position.
3. FEED the signal sine wave (20 to 50mV) to the input of CE amplifier and observe the Vi voltage on Ch-1 &output Vo voltage on Ch-2.
4. keeping the input signal unchanged select the range switch (10Hz-1MHz) in steps.
5. Note down the Vo output voltage amplitude for different frequency {15H, 25Hz, 100Hz…1MHz}
6. Tabulate the results in tabular form.
7. After calculation Av and gain in dB using semi-logarithm sheet plot the curve

TABULAR COLUMN: **Input = 50mV**

Frequency (in Hz)	Output Voltage (V_o)	Gain $A_v=V_o/V_i$	Gain(in dB) $=20\log_{10}(V_o/V_i)$
20			
50			
100			
1k			
10k			
100k			
200,500K			
1M			

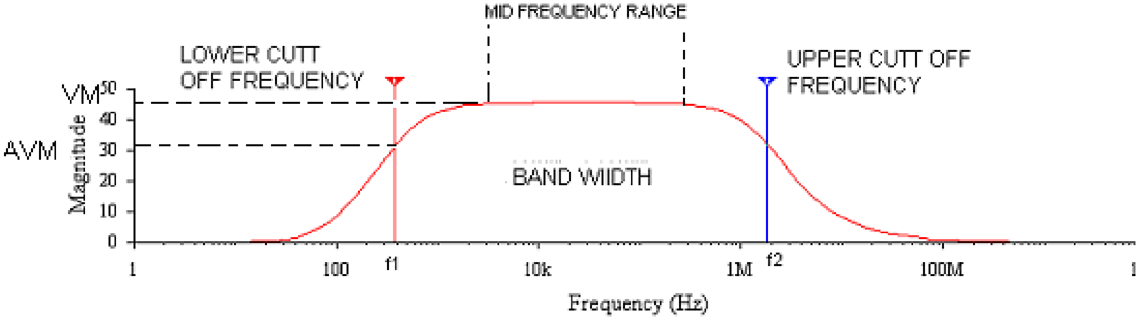
EXPECTED WAVE FORMS:

INPUT WAVE FORM:



OUTPUT WAVE FORM

FREQUENCY RESPONSE



PRECAUTIONS:

1. Avoid loose connections give proper input voltage

RESULT: -

1. Frequency response of BJT amplifier is plotted.
2. Gain = _______dB (maximum).
3. Bandwidth= f_H-f_L = _________Hz

VIVA QUESTIONS

1. What is phase difference between input and output waveforms of CE amplifier?
2. What type of biasing is used in the given circuit?
3. If the given transistor is replaced by a p-n-p, can we get output or not?
4. What is effect of emitter-bypass capacitor on frequency response?
5. What is the effect of coupling capacitor?
6. What is region of the transistor so that it is operated as an amplifier?
7. How does transistor acts as an amplifier?
8. Draw the h-parameter model of CE amplifier?
9. What type of transistor configuration is used in intermediate stages of a multistage amplifier?
10. What is Early effect?
11. For a common-emitter amplifier, the purpose of the emitter bypass capacitor is

REALTIME APPLICATIONS:

Common-emitter amplifiers are also used in radio frequency circuits, for example to amplify faint signals received by an antenna In this case it is common to replace the load resistor with a tuned circuit. This may be done to limit the bandwidth to a narrow band centered around the intended operating frequency. More importantly it also allows the circuit to operate at higher frequencies as the tuned circuit can be used to resonate any inter-electrode and stray capacitances, which normally limit the frequency response. Common emitters are also commonly used as low-noise amplifiers

EXP - 10 B

COMMON COLLECTOR AMPLIFIER CHARACTERISTICS

AIM: -

To plot frequency response of CC amplifier and calculate gain & bandwidth.

EQUIPMENTS & COMPONENTS REQUIRED:

S.NO	Device	Range/Rating	Qty
1.	(a) Regulated DC supply voltage	0-30V	1
2	Function generator	1MHz	1
2.	Dual trace CRO(oscilloscope)	25MHz	1
3.	BJT	BC107 OR 2N2222,BC547	1
4.	Connecting wires		
5.	Capacitor	10µf=2,100 µf	
6.	Resistor		

THEORY:

A transistor is a three terminal active device. The terminals are emitter, base, collector. In CB configuration, the base is common to both input (emitter) and output (collector). For normal operation, the E-B junction is forward biased and C-B junction is reverse biased. In CB configuration, IE is +ve, IC is –ve and IB is –ve. So, VEB=f1 (VCB,IE) and IC=f2 (VCB,IB) With an increasing the reverse collector voltage, the space-charge width at the output junction increases and the effective base width 'W' decrease.This phenomenon is known as "Early effect". Then, there will be less chance for recombination within the base region. With increase of charge gradient within the base region, the current of minority carriers injected across the emitter junction increases.The current amplification factor of CB configuration is given by, $\alpha = \Delta IC / \Delta IE$

In common-collector amplifier the input is given at the base and the output is taken at the emitter. In this amplifier, there is no phase inversion between input and output. The input impedance of the CC amplifier is very high and output impedance is low. The voltage gain is less than unity. Here the collector is at ac ground and the capacitors used must have a negligible reactance at the frequency of operation. This amplifier is used for impedance matching and as a buffer amplifier. This circuit is also known as emitter follower.

CIRCUIT DIAGRAM:

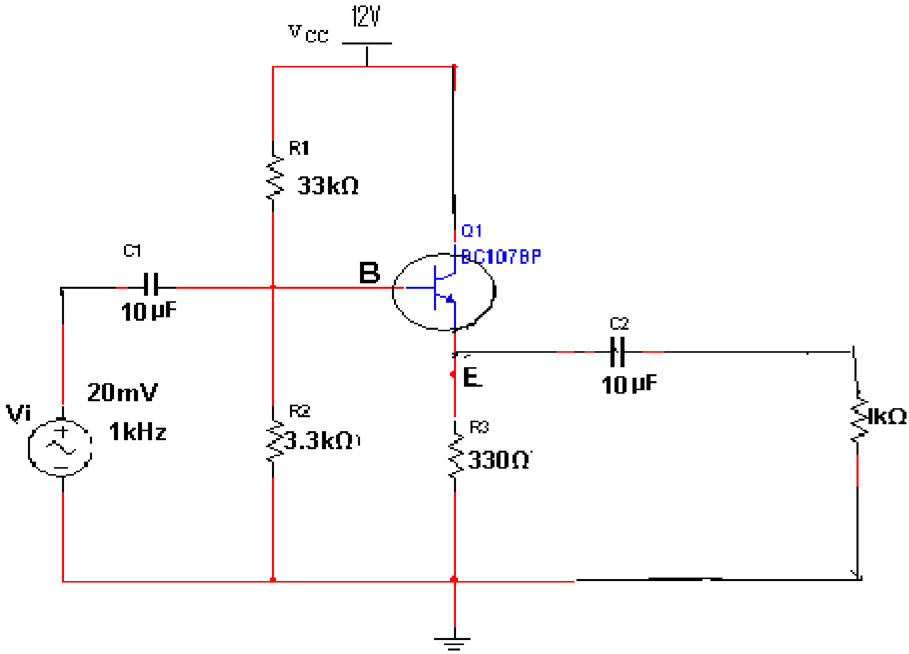


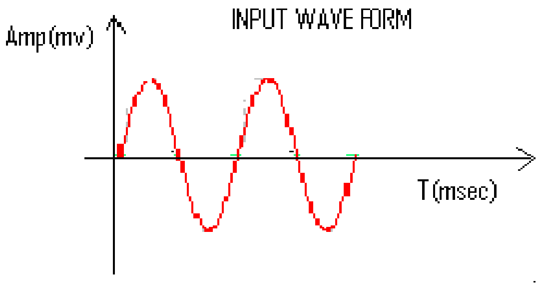
Fig: 3 Circuit Diagram of Common Emitter Amplifier

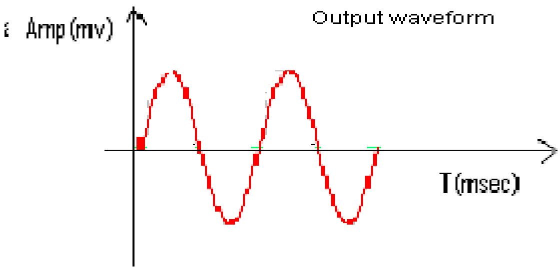
PROCEDURE: -

1. Connect the circuit according to the circuit diagram as shown in figure on breadboard.
2. Set the power supply at 12V and function generator signal amplitude (20 to 50mV) for (sine wave) 1 KHz frequency on CH-1knob to minimum position.
3. FEED the signal sine wave (20 to 50mV) to the input of CE amplifier and observe the Vi voltage on Ch-1 &output Vo voltage on Ch-2.
4. keeping the input signal unchanged select the range switch (10Hz-1MHz) in steps.
5. Note down the Vo output voltage amplitude for different frequency {15H, 25Hz, 100Hz…1MHz}

6. Tabulate the results in tabular form.
7. After calculation Av and gain in dB using semi-logarithm sheet plot the curve.

WAVEFORM:





Frequency Response Curve

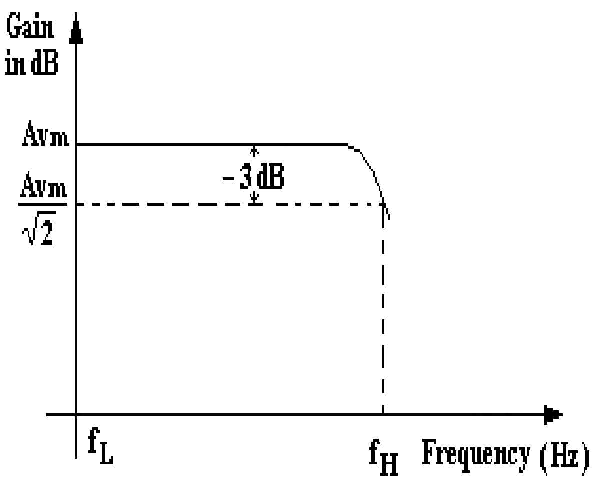


Fig: 4 Input and Output waveforms /Frequency Response of CE Amplifier

PRECAUTIONS:

1. The input voltage must be kept constant while taking frequency response.

2. Proper biasing voltages should be applied.

RESULT:

The voltage gain and frequency response of the CC amplifier are obtained. Also gain Bandwidth product is calculate

VIVA QUESTIONS:

1. What are the applications of CC amplifier?
2. What is the voltage gain of CC amplifier?
3. What are the values of input and output impedances of the CC amplifier?
4. To which ground the collector terminal is connected in the circuit?
5. Identify the type of biasing used in the circuit?
6. Give the relation between α, β and γ.
7. Write the other name of CC amplifier?
8. What are the differences between CE, CB and CC?
9. When compared to CE, CC is not used for amplification. Justify youranswer?
10. What is the phase relationship between input and output in CC?
11.What is the type of capacitor used in RC coupled amplifier for a) coupling two phases
12.What is signal source used for experiment of an RC coupled amplifier and how much maximum voltage it could give
13.How do you determine AC power output in class A amplifier i.e., do you measure current or voltage and how?
14. What are the applications of CC amplifier?
15. What is the voltage gain of CC amplifier?
16. What are the values of input and output impedances of the CC amplifier?
17. To which ground the collector terminal is connected in the circuit?
18. Identify the type of biasing used in the circuit?

EXP 11
INPUT AND OUTPUT CHARACTERISTICS OF FET IN CS CONFIGURATION

AIM: To study the Drain and Transfer characteristics of FET

EQUIPMENTS & COMPONENTS REQUIRED:

S.No	Device	Range/Rating	Qty
1.	(a) Regulated DC supply voltage	0-30V	1
2.	Voltmeter	,0-20V	2
3.	Ammeter	0-10mA or 200Ma	1
4.	Connecting wires & bread board		
5.	FET transistor	BFW10/11 or BF245A	1
6.	Resistor	100Ω,560Ω	1each

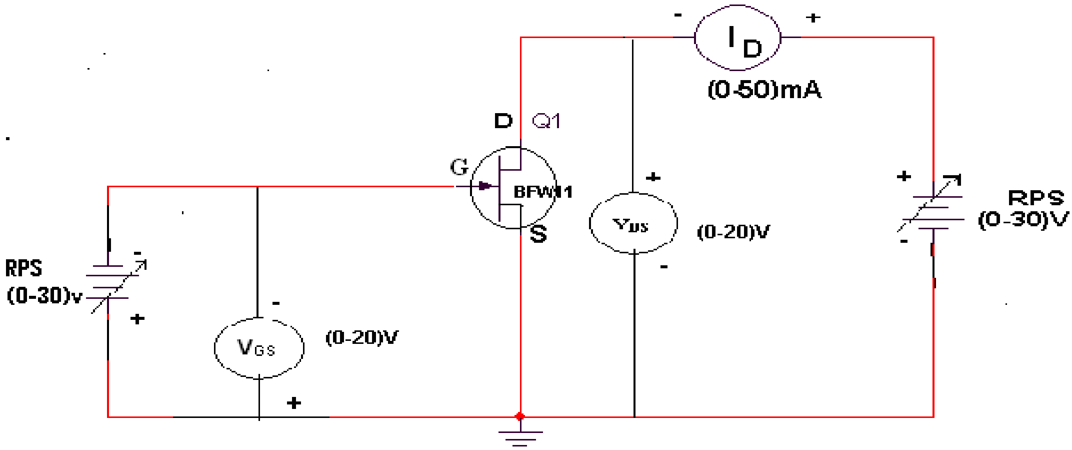
Theory:

The **field-effect transistor** (FET) is a transistor that uses an electric field to control the shape and hence the conductivity of a channel of one type of charge carrier in a semiconductor material. FETs are unipolar transistors as they involve single-carrier-type operation.

A FET is a three-terminal device, having the characteristics of high input impedance and less noise, the Gate to Source junction of the FET s always reverse biased. In response to small applied voltage from drain to source, the ntype bar acts as sample resistor, and the drain current increases linearly with VDS. With increase in ID the ohmic voltage drop between the source and the channel region reverse biases the junction and the conducting position of the channel begins to remain constant. The VDS at this instant is called “pinch of voltage”.

If the gate to source voltage (VGS) is applied in the direction to provide additional reverse bias, the pinch off voltage ill is decreased. In amplifier application, the FET is always used in the region beyond the pinch-off.

CIRCUIT DIAGRAM:



PROCEDURE: -

Drain or Static characteristics

1. Connect the circuit according to the circuit diagram as shown in figure.
2. Keep the power supply knob to minimum position.
3. Switch on supply keep the gate to source voltage VGS=0V.
4. Increase the drain supply VDD from 0V onwards in steps.
5. Note down current Id and Drain to source voltage VDS without exceeding the rated Value.
6. Repeat the above procedure for VGS=-1V,-0.5V
7. Tabulate the results and plot the graph.

Transfer characteristics:

1. keeping the same circuit connections bring the Knobs of supply t minimum.
2. Now vary VDS drain to source voltage at 1V by Varying VDD Drain supply voltage.
3. Increasing the gate to source voltage VGS from 0V onwards in suitable steps..
4. Note down the corresponding variation in ID until it becomes 0V .
5. Repeat the above 3 step for VDS=2V & 4V constant
6. Tabulate the results and plot graph.

Tabular coloumn

Drain or Static characteristics

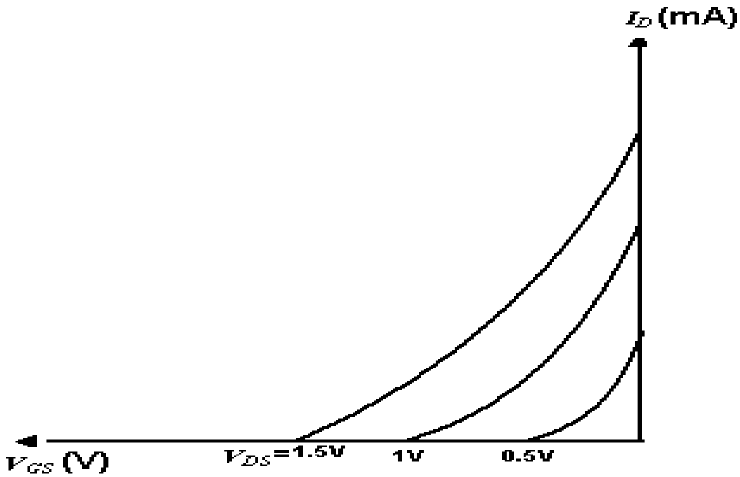
V_{GS}=0		V_{GS}=0.5		V_{GS}=0.1	
V_{DS} in volts	I_D in mA	V_{DS} in volts	I_D in mA	V_{DS} in volts	I_D in mA

Transfer characteristics

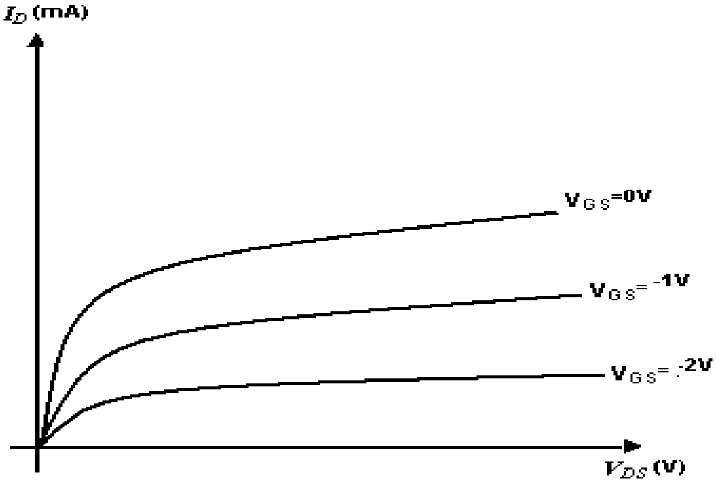
V_{DS}=-1		V_{DS}=-2		V_{DS}=-3	
V_{GS} in volts	I_D in mA	V_{GS} in volts	I_D in mA	V_{GS} in volts	I_D in mA

<u>EXPECTED GRAPH</u>:

TRANSFER CHARACTERISTICS



DRAIN CHARACTERISTICS



PRECAUTIONS:

1. Alwaya keep the supply voltage knobs i.e VDD, VGG position at minimum position when switching on and off
2. Practically FET contains four terminals, which are called source, drain, Gate, substrate.
3. Source and case should be short circuited.
4. Voltages exceeding the ratings of the FET should not be applied.
5. Never load the meters above the rated range.
6. Avoid loose contacts at the junction.

RESULT: Thus the Drain characteristics of FET are observed and plotted

REALTIME APPLICATIONS:

Low Noise Amplifier. Noise is an undesirable disturbance super-imposed on a useful signal. Noise interferes with the information contained in the signal; the greater the noise, the less the information. For instance, the noise in radio-receivers develops crackling and hissing which sometimes completely masks the voice or music. Similarly, the noise in TV receivers produces small white or black spots on the picture; a severe noise may wipe out the picture. Noise is independent of the signal strength because it exists even when the signal is off.

A buffer amplifier is a stage of amplification that isolates the preceding stage from the following stage. Source follower (common drain) is. used as a buffer amplifier. Because of the high input impedance and low output impedance a FET acts an excellent buffer amplifier, as shown in figure. Owing to high input impedance almost all the output voltage of the preceding stage appears at the input of the buffer amplifier and owing to low output impedance all the output voltage from the buffer amplifier reaches the input of the following stage, even there may be a small load resistance.

VIVA QUESTIONS:

1. Why FET is called as a unipolar device?
2. Name the terminals of FET?
3. What is the difference between BJT and FET?
4. What arte the major applications of FET?
5. What are the advantages of FET?
6. Difference between MOSFET and FET?
7. Give the applications MOSFET?
8. What is the basis confurgation of JFET?
9. What is deplition mode and enhance mode?
10. What is trans-conductance and amplification factor?
11. Why FET is called as a unipolar device/
12. Name the terminals of FET?
13. What is the difference between BJT and FET?
14. What arte the major applications of FET?
15. What are the advantages of FET?

16. Difference between MOSFET and FET?
17. Give the applications MOSFET?
18. What is the basis confurgation of JFET?
19. What is deplition mode and enhance mode?
20. What is trans-conductance and amplification factor?
21. Why FET is called as a unipolar device/
22. Name the terminals of FET?
23. What is the difference between BJT and FET?
24. What arte the major applications of FET?
25. What are the advantages of FET?
26. Difference between MOSFET and FET?
27. Give the applications MOSFET?
28. What is the basis confurgation of JFET?
29. What is deplition mode and enhance mode?
30. What is trans-conductance and amplification factor?

EXP NO: 12

COMMON SOURCE AMPLIFIER CHARACTERISTICS

FREQUENCY RESPONSE OF COMMON SOURCE FET AMPLIFIER

AIM: -

1. To plot frequency response of CS amplifier (common source) and calculate gain & bandwidth.

EQUIPMENTS & COMPONENTS REQUIRED:

S.No	Device	Range/Rating	Qty
1.	(a) Regulated DC supply voltage	0-30V	1
2	Function generator	1MHz	1
2.	Dual trace CRO(oscilloscope)	25MHz	1
3.	FET	BFW10/11 or BF245	1
4.	Connecting wires		
5.	Capacitor	10µf=2,100 µf	
6.	Resistor	1K,4.7K,1M,1K	

THEORY:

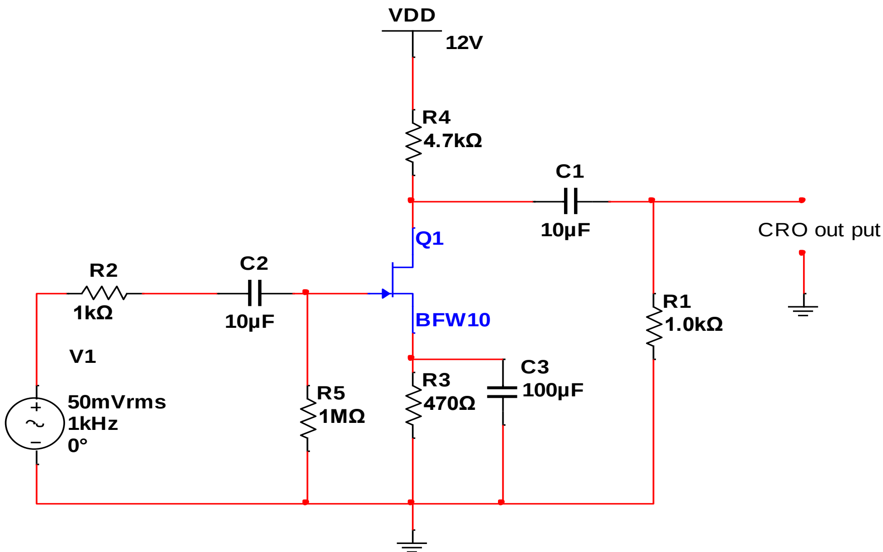
A field-effect transistor (FET) is a type of transistor commonly used for weak-signal amplification (for example, for amplifying wireless (signals). The device can amplify analog or digital signals. It can also switch DC or function as an oscillator. In the FET, current flows along a semiconductor path called the channel. At one end of the channel, there is an electrode called the source. At the other end of the channel, there is an electrode called the drain. The physical diameter of the channel is fixed, but its effective electrical diameter can be varied by the application of a voltage to a control electrode called the gate. Field-effect transistors exist in two major classifications. These are known as the junction FET (JFET) and the metal-oxide- semiconductor FET (MOSFET). The junction FET has a channel consisting of N-type semiconductor (N channel) or P-type semiconductor (P-channel) material; the gate is made of the opposite semiconductor type. In P-type material, electric charges are carried mainly in the form of electron deficiencies called holes. In N-type material, the charge carriers are primarily electrons. In a JFET, the junction is the boundary between the channel and the gate. Normally, this P-N junction is reverse-biased (a DC voltage is applied to it) so that no current flows between the channel and the gate. However, under some conditions there is a small current through the junction during part of the input signal cycle. The FET has some advantages

and some disadvantages relative to the bipolar transistor. Field-effect transistors are preferred for weak-signal work, for example in wireless, communications and broadcast receivers. They are also preferred in circuits and systems requiring high impedance. The FET is not, in general, used for high-power amplification, such as is required in large wireless communications

and broadcast transmitters. Field-effect transistors are fabricated onto silicon integrated circuit (IC) chips. A single IC can contain many thousands of FETs, along with other components

such as resistors, capacitors, and diodes.

CIRCUIT DIAGRAM:



PROCEDURE:

1. Connect the circuit according to the circuit diagram as shown in figure on breadboard.

2. Set the power supply at 12V and function generator signal amplitude (20 to 50mV) for (sine wave) 1 KHz frequency on CH-1knob to minimum position.
3. FEED the signal sine wave (20 to 50mV) to the input of CE amplifier and observe the Vi voltage on Ch-1 &output Vo voltage on Ch-2..
4. keeping the input signal unchanged select the range switch (10Hz-1MHz) in steps.
5. Note down the Vo output voltage amplitude for different frequency {15H, 25Hz, 100Hz…1MHz}
6. Tabulate the results in tabular form.
7. After calculation Av and gain in dB using semi-logarithm sheet plot the curve.

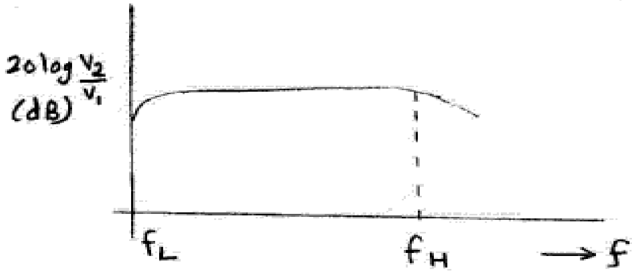
PRECAUTIONS:

1. Avoid loose connections and give proper input Voltage

TABULAR COLUMN: Input = 50mV

Frequency (in Hz)	Output Voltage (V_o)	Gain $A_v=V_o/V_i$	Gain(in dB) $=20\log_{10}(V_o/V_i)$
10			
50			
100			
1K			
10k			
50K,100K			
200k,500K			
1M			

EXPECTED GRAPH:



RESULT: -

1. Frequency response of FET Common source amplifier is plotted.
2. Gain = _______dB (maximum).
3. Bandwidth= f_H-f_L = _________Hz.

VIVA QUESTIONS:

1. What is Miller effect on common source amplifier?
2. What is the purpose of source resistor and gate resistor?
3. What is swamping resistor
4. What is the purpose of swamping resistor in common source amplifier
5. FET is a liner or non-linear device. And justify your answer
6. What is square law and give an example for a square law device
7. A common-gate amplifier is similar in configuration to which BJT amplifier?
8. The *theoretical* efficiency of a class D amplifier is
9. A common-source amplifier is similar in configuration to which BJT amplifier?
10. A BJT is a ________-controlled device.
11. A common-drain amplifier is similar in configuration to which BJT amplifier?
12. For what value of I_D is g_m equal to 0.5 g_{m0}?
13. Where do you get the level of g_m and r_d for an FET transistor?
14. The class D amplifier uses what type of transistors?
15. What is the input resistance ($R_{in(source)}$) of a common-gate amplifier?
16. Which of the following is a required condition to simplify the equations for Z_o and A_v for the self-bias configuration?
17. The steeper the slope of the I_D versus V_{GS} curve, the ________ the level of g_m
18. What is the typical value for the input impedance Z_i for JFETs?
19. MOSFET digital switching is used to produce which digital gates?
20. Which type of FETs can operate with a gate-to-source Q-point value of 0 V?
21. What is Miller effect on common source amplifier?

22. What is the purpose of source resistor and gate resistor?
23. What is swamping resistor
24. What is the purpose of swamping resistor in common source amplifier
25. FET is a liner or non-linear device. And justify your answer
26. What is square law and give an example for a square law device
27. A common-gate amplifier is similar in configuration to which BJT amplifier?
28. The *theoretical* efficiency of a class D amplifier is
29. A common-source amplifier is similar in configuration to which BJT amplifier?
30. A BJT is a _________-controlled device

EXPT NO:13

TEST THE POWERED BACKUP SYSTEM USING DIODE

AIM:

To Design and Implement back up system using a PN Junction diode

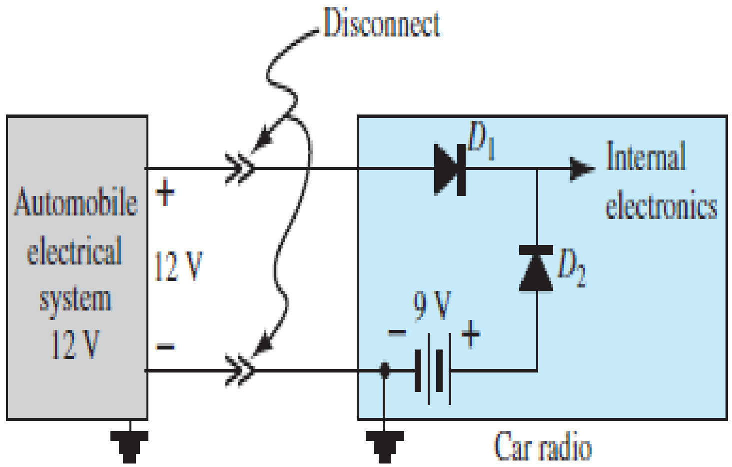
EQUIPMENTS & COMPONENTS REQUIRED:

S.No	Device	Range/Rating	Qty
1.	RPS	0-30V	2
2.	Diodes	,0-20V	2

Theory:

In numerous situations a system should have a backup power source to ensure that the system will still be operational in case of a loss of power. This is especially true of security systems and lighting systems that must turn on during a power failure. It is also important when a system such as a computer or a radio is disconnected from its ac-to-dc power conversion source to a portable mode for traveling. In Fig., 12-V car radio operating off the 12-V dc power source has a 9-V battery backup system in a small compartment in the back of the radio ready to take over the role of saving the clock mode and the channels stored in memory when the radio is removed from the car. With the full 12 V available from the car, *D* 1 is conducting, and the voltage at the radio is about 11.3 V. *D* 2 is reverse biased (an open circuit), and the reserve 9-V battery inside the radio is disengaged. However, when the radio is removed from the car, *D* 1 will no longer be conducting because the 12-V source is no longer available to forward-bias the diode. However, *D* 2 will be forward-biased by the 9-V battery, and the radio will continue to receive about 8.3 V to maintain the memory that has been set for components such as the clock and the channel selections.

CIRCUIT DIAGRAM



PROCEDURE: -

1. Connect the circuit according to the circuit diagram as shown in figure on breadboard.
2. Set the power supply at 12V and disconnect 12V you can observe the backup voltage provided by the diodes

RESULT:

Implementation of backup system using PN junction diode is observed.

Viva Questions

1. What is back up battery power?

2. How does power back work?

3.List the types of power backup system?

4.What is inverter power back up?

5.What are the different UPS?

6. What is the difference between UPS and CBS?

EXP NO: 14
SCR CHARACTERISTICS

AIM: -

1. To study the characteristics of SCR

EQUIPMENTS & COMPONENTS REQUIRED:

S.No	Device	Range/Rating	Qty
1.	(a) Regulated DC supply voltage	0-30V	1
2.	Voltmeter	,0-20V	2
3.	Ammeter	0-10mA or 200mA	1
4.	Connecting wires		
5.	SCR	TYN604 or 616	
6.	Resistor	lK,10K	

THEORY:

A **silicon-controlled rectifier** (or **semiconductor-controlled rectifier**) is a four-layer solid state current controlling device. The name "silicon controlled rectifier" is General Electric's trade name for a type of thyristor. The SCR was developed by a team of power engineers led by Gordon Hall and commercialized by Frank W. "Bill" Gutzwiller in 1957. The . Silicon Control Rectifier (SCR) consists of four layers of semiconductors, which form **NPNP** or **PNP** structures. It has three junctions, labeled **J1**, **J2**, and **J3** and three terminals. The anode terminal of an SCR is connected to the P-Type material of a PNPN structure, and the cathode terminal is connected to the N-Type layer, while the gate of the Silicon Control Rectifier SCR is connected to the P-Type material nearest to the cathode. SCRs are unidirectional devices (i.e. can conduct current only in one direction) as opposed to TRIACs which are bidirectional (i.e. current can flow through them in either direction). SCRs can be triggered normally only by currents going into the gate as opposed to TRIACs which can be triggered normally by either a positive or a negative current applied to its gate electrode. SCRs are mainly used in devices where the control of high power, possibly coupled with high voltage, is demanded. Their operation (it can switch large current on and off) makes them suitable for use in medium to high-voltage AC power control applications, such as lamp dimming, regulators and motor control. SCRs and similar devices are used for rectification of high-power AC in high-voltage direct current power transmission. They are also used in the control of welding machines, mainly MTAW (Metal Tungsten Arc Welding) and GTAW (Gas Tungsten Arc Welding) process.

CIRCUIT DIAGRAM:

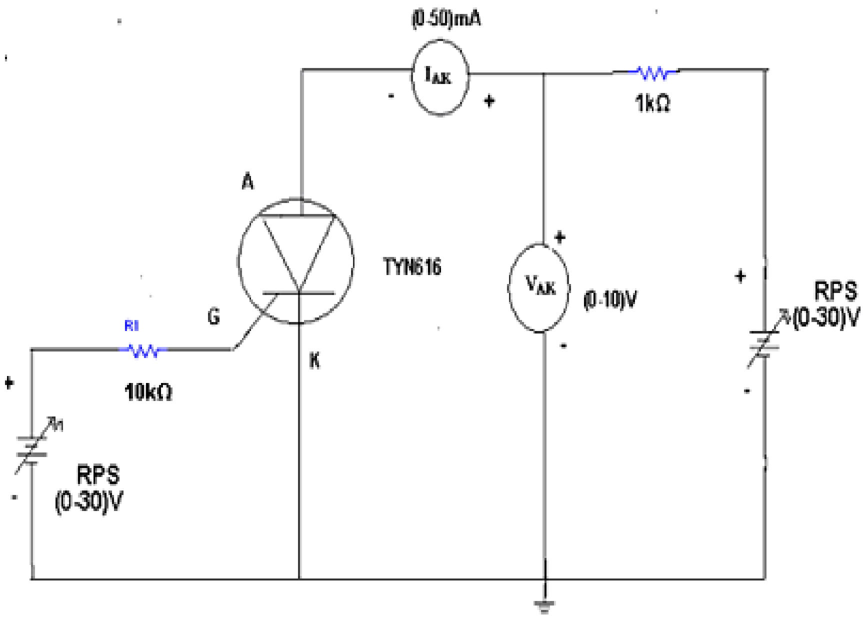


Fig 1 Circuit diagram of SCR Characteristics

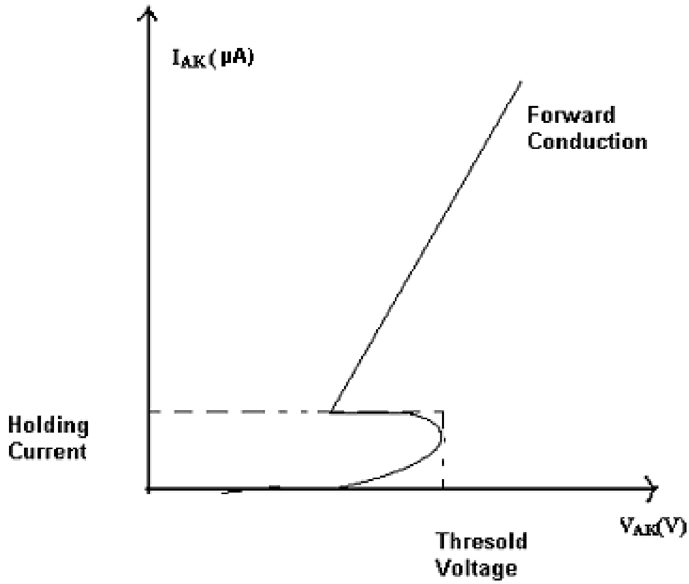
PROCEDURE: -

1. Connect the circuit according to the circuit diagram as shown in figure.
2. Keep the power supply knob to minimum position.
3. Set $V_{AA\ starting}$ from zero gradually until the current begins to rise and the voltage V suddenly drops to low value.
4. Note the reading V & I just before and immediately after the firing on the SCR.
5. Repeat step 3 for various values of IG say 10mA & 8mA
6. Tabulate the reading in the table. Note down the latching and holding currents from the plot

OBSERVATION TABLE:

V_{AK}(V)	I_{AK} (mA)

EXPECTED WAVEFORM:



RESULT: SCR Characteristics are observed and values are tabulated.

VIVA QUESTIONS:

1. How many junctions are there in SCR?
2. Name few applications of SCR?
3. Name the types of SCR?
4. IS SCR a unidirectional device?
5. What do you mean by holding current and holding voltage?
6. What is meant by the term break over voltage?
7. What is the usual method of switching off and SCR?

8. What is Thyristor?
9. What are Diac and Triac?
10. What does latching of an SCR mean?
11. What is asymmetrical SCR?
12. Why is Peak Reverse Voltage Important?
13. What are the applications of SCR?
14. What is the difference between SCR and TRIAC?
15. What is an SCR?
16. What are the difference between transistor and SCR?
17. Explain latching current and holding current of the thyristor
18. What are the advantages of MOSFET's over BJT's?
19. Why pulsed gate drive is used for SCR?
20. Define the delay angle of phase-controlled rectifier.
21. Why is power factor of semi converter better than full converter?
22. What are the differences between freewheeling diode and feedback diode?
23. What is inverting operation of the converter?
24. What are control strategies of chopper?
25. Explain the use of step-up chopper.
26. What is four quadrant chopper?
27. Name few applications of SCR?
28. Name the types of SCR?
29. IS SCR a unidirectional device?
30. What do you mean by holding current and holding voltage?