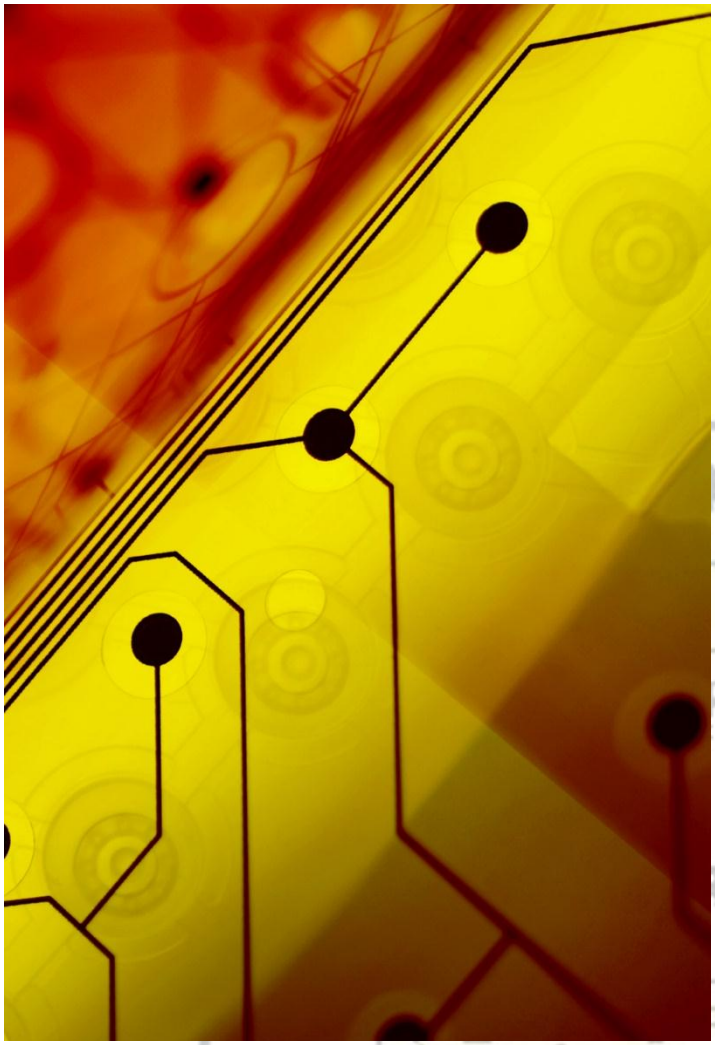


[Question Bank]

LAB:

ELECTRONIC DEVICES

Code: ECE-251

Subject Teacher:

Er. Jaspreet Singh Kaleka

Semester IIIrd

This booklet Includes:

- List of Equipments
- List of Softwares
- List of Experiments
- lab Manual
- Question Bank

ECE 251 ELECTRONIC DEVICES LAB

Quiz Questions

Experiment #1
Study of h-Parameters of CE transistor

Q1. What is the range of Amplification factor beta (β) for CE configuration?

Ans: Amplification factor beta (β) for CE configuration usually ranges from 20-500.

Q2. To operate a transistor as amplifier, emitter junction is forward biased and collector junction is reverse biased. Why?

Ans: Voltage is directly proportional to Resistance. Forward bias resistance is very less compared to reverse bias. In amplifier input forward biased and output reverse biased so voltage at output increases with reverse bias resistance.

Q3. For amplification CE is preferred, why?

Ans: Amplification factor beta (β) for CE configuration usually ranges from 20-500, hence this configuration gives appreciable current gain as well as voltage gain at its output.

Q4. Which transistor configuration provides a phase reversal between the input and output signals?

Ans: Common emitter (CE) configuration.

Q5. Can transistor be replaced by two back to back connected diodes?

Ans: No, because the doping levels of emitter (heavily doped), base (lightly doped) and collector (doping level greater than base and less than emitter) terminals are different from *p* and *n* terminals in diode.

Q6. Why the doping of collector is less compared to emitter?

Q7. What are the input and output impedances of CE configuration?

Q8. What is the relation between α, β and γ?

Q9. Define current gain in CE configuration?

Q10. Draw diagram of CE configuration for PNP transistor?

Q11. What is the power gain of CE configuration?

Q12. What are the applications of CE configuration?

Experiment #2
Study of h-Parameters of CB transistor

Q1. Define common-base current gain (α) for CB configuration?

Ans: The common-base current gain, α is the gain of current from emitter to collector in the forward-active region.

Q2. What is the range of common-base current gain (α) for CB configuration?

Ans: Common-base current gain (α) for CB configuration usually has a value close to unity, between 0.98 and 0.998.

Q3. Why common-base current gain (α) for CB configuration is less than unity?

Ans: Common-base current gain (α) for CB configuration is less than unity due to recombination of charge carriers as they cross the base region.

Q4. Why a common emitter transistor is preferred over a common base transistor?

Ans: Because the current gain in CE configuration is much larger than that in CB configuration.

Q5.What is the relation between CB current gain (α) and CE current gain (β)?

Q6. What is the doping level of E, B and C layers?

Q7. What are the input and output impedances of CB configuration?

Q8. Draw diagram of CB configuration for PNP transistor?

Q9. What is the power gain of CB configuration?

Q10. What are the applications of CB configuration?

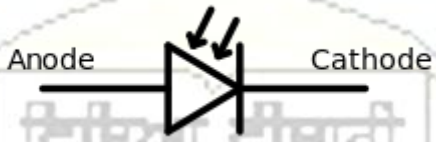
Experiment #3
Study of V-I characteristics of Photodiode

Q1. What is Photo Diode?

Ans: A photodiode light sensitive PN-junction diode that is capable of converting light energy into a voltage or current signal. It works on the principle of photo generation. Sometimes it is also called as photo-detector, a light detector, and photo-sensor. These diodes are particularly designed to work in reverse bias condition

Q2. Draw the symbol of Photodiode?

Ans: Photo diode has two terminals anode and cathode. The incoming arrows indicate the light rays falling on photo diode.



Q3. List different types of Photodiodes.

Ans: The types of the photodiodes can be classified based on its construction and functions as, *PN junction* Photodiode, *Schottky* Photodiode, *PIN* Photodiode, *Avalanche* Photodiode.

Q4. What are different modes of operation of Photodiode?

Ans: The operating modes of the photodiode include three modes, namely *Photovoltaic* mode, *Photoconductive* mode and *Avalanche diode* mode.

Photovoltaic Mode: This mode is also known as *zero bias* mode, in which a voltage is produced by the lightened photodiode. It gives a very small dynamic range of the voltage formed.

Photoconductive Mode: The photodiode used in this mode is more usually reverse biased. The reverse voltage application will increase the depletion layer's width, which in turn decreases the response time and the junction capacitance.

Avalanche Diode Mode: Avalanche diodes operate in a high reverse bias condition, which permits multiplication of an avalanche breakdown to each photo-produced electron-hole pair. This outcome in an internal gain in the photodiode, which slowly increases the device response.

Q5. What are various types of photo excitations?

Ans: There can be two types of photo excitations, Intrinsic excitation and Extrinsic excitation. Intrinsic excitation occurs when an electron in valence band is excited by a high energy photon to conduction band. Alternatively, a photon may excite an electron in donor level to conduction band or a valence band electron may go into acceptor state. Such excitations are termed as extrinsic excitations.

Q6. What is Dark current?

Ans: Dark current is the current through the photodiode for zero illumination (luminance). It will be non-zero due to back ground radiation and thermally excited minority saturation current. It is of the order of nano amperes.

Q7. Define Responsivity of photodiode.

Ans: Responsivity is defined as the ratio of photo generated current to incident light power. It is measured in units of amp/watt.

Q8. Define Quantum efficiency of photodiode.

Ans: Quantum efficiency is defined as fraction of incident photons contributing to photo current. It is a *unit less* quantity.

Q9. What is the relation between Responsivity and Quantum Efficiency of photodiode?

Q10. Write the current equation of photodiode.

Q11. What are the applications of photodiode?

Experiment #4
Study of V-I characteristics of Photo Transistor

Q1. What is Photo Transistor?

Ans: A Phototransistor is an electronic switching and current amplification component which relies on exposure to light to operate. When light falls on the junction, reverse current flows which is proportional to the luminance. Phototransistors are used extensively to detect light pulses and convert them into digital electrical signals. These are operated by light rather than electric current. Providing large amount of gain, low cost and these phototransistors might be used in numerous applications.

Q2. What is Dark Current?

Ans: When the phototransistor is placed in the dark and a voltage is applied from collector to emitter, a certain amount of current will flow. This current is called the dark current. This current consists of the leakage current of the collector-base junction multiplied by the DC current gain of the transistor. The presence of this current prevents the phototransistor from being considered completely "off", or being an ideal "open" switch.

Q3. Is Dark Current dependent on temperature?

Ans: Dark current is temperature dependent, increasing with increasing temperature.

Q4. Draw the symbol of photo transistor.

Q5. Explain the working principle of photo transistor.

Q6. Draw the VI characteristics of photo transistor.

Q7. What are the application of photo transistor?

Q8. What are the advantages of photo transistor?

Q9. What are the disadvantages of photo transistor?

Experiment #5
Study of V-I characteristics of JFET

Q1. Why JFET is called a Unipolar device?

Ans: FETs are unipolar transistors as they involve single-carrier-type operation.

Q2. What are the advantages of JFET?

Q3. What are the disadvantages of JFET?

Q4. What is transconductance in JFET? Write its equation.

Q5. What is the importance of high input impedance of JFET?

Q6. Why wedge shaped depletion region is formed in JFET under reverse bias gate condition?

Q7. Why JFET is less noisy than BJT?

Q8. What is the difference between n-channel JFET and p-channel JFET?

Q9. What is drain current in JFET? Write its equation.

Q10. Draw the symbols of n-channel JFET and p-channel JFET.

Experiment #6
Study of V-I characteristics of MOSFET

Q1. What is MOSFET?

Q2. How is MOSFET different from a JFET?

Q3. What are the types of MOSFET?

Q4. What are the advantages of MOSFET?

Q5. What are the disadvantages of MOSFET?

Q6. Explain the working principle of MOSFET.

Q7. Draw the symbols of MOSFET.

Q8. What is the difference between d-MOSFET and e-MOSFET?

Q9. Draw VI characteristics of MOSFET.

Q10. What are the applications of MOSFET?

Experiment #7
Study of Clipping and clamping circuits using Diode

Q1. What is Clipping?

Q2. What are the types of Clipping circuits?

Q3. What is Clamping?

Q4. What are the types of Clamping circuits?

Q5. What is the difference between Clipping and Clamping?

Q6. Explain the working principle of Series Clipper.

Q7. Explain the working principle of Parallel Clipper.

Q8. Explain the working principle of Negative Clamper.

Q9. Explain the working principle of Positive Clamper.

Q10. What are the applications of Clipper?

Q11. What are the applications of Clamper?

Experiment #8
Study of V-I characteristics of SCR

Q1. What is an SCR?

Ans: Silicon-controlled rectifier (or semiconductor-controlled rectifier) is a four-layer solid state current controlling device. The name "silicon controlled rectifier" or SCR is General Electric's trade name for a type of thyristor.

Q2. What is the difference between SCR and TRIAC?

Ans: 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.

Q3. What are the applications of SCR?

Ans: SCRs are mainly used in devices where the control of high power, possibly coupled with high voltage, is demanded. Their operation 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.

Q4. Why is Peak Reverse Voltage important in SCR?

Ans: When an SCR is used for rectification, during the negative half cycle of given AC supply, reverse voltage is applied across the SCR. If Peak Reverse Voltage is exceeded, there may be an avalanche breakdown and the SCR will be damaged (unless the external circuit limits the current). Commercial SCRs have a PRV up to 2.5kV.

Q5. What is asymmetrical SCR?

Ans: SCR incapable of blocking reverse voltage are known as asymmetrical SCR, abbreviated ASCR. They typically have a reverse breakdown rating in the 10's of volts. ASCR are used where either a reverse conducting diode is applied in parallel (for example, in voltage source inverters) or where reverse voltage would never occur (for example, in switching power supplies or DC traction choppers).

Q6. Draw VI characteristics of SCR.

Q7. In the normal operation of an SCR, anode is positive w.r.t cathode. Is this true?

Q8. In the normal operation of an SCR, gate is positive w.r.t cathode. Is this true?

Q9. SCR is a 4 layer and 3 junction device. Is this true?

Q10. SCR can block both forward and reverse voltage but conducts in forward. Is this true?

Experiment #9
Study of Diode as Rectifier

Q1. What is a Rectifier?

Ans: A rectifier is an electrical device that converts alternating current (AC), which periodically reverses direction, to direct current (DC), which flows in only one direction. The process is known as rectification.

Q2. What is Ripple Factor of a rectifier?

Ans: Ripple factor can be defined as the variation of the amplitude of DC (Direct current) due to improper filtering of AC power supply.

Q3. What is Rectifier Efficiency?

Ans: Rectifier efficiency is the ratio of the DC output power to the AC input power.

Q4. What is PIV?

Ans: The peak inverse voltage is either the specified maximum voltage that a diode rectifier can block, or, alternatively, the maximum that a rectifier needs to block in a given application.

Q5. What are the applications of rectifier?

Ans: The primary application of rectifiers is to derive DC power from an AC supply. Virtually all electronic devices require DC, so rectifiers are used inside the power supplies of virtually all electronic equipment. Rectifiers are also used for detection of amplitude modulated radio signals. rectifiers are used to supply polarised voltage for welding.

Q6. Why step down transformer is used in HWR?

Q7. What is the output of HWR? Is it unidirectional or constant?

Q8. What is the efficiency of bridge rectifier?

Q9. What is the value of PIV of a centre tapped FWR?

Q10. What is TUF?

Q11. What are the advantages and disadvantages of centre tapped FWR compared with Bridge rectifiers?

Experiment #10

Study of different filters

Q1. What is filter?

Ans: Electronic filters are electronic circuits which perform signal processing functions, specifically to remove unwanted frequency components from the signal.

Q2. In filters capacitor is always connected in parallel, why?

Ans: Capacitor allows AC and blocks DC signal.in rectifier for converting AC to DC, capacitor placed in parallel with output, where output is capacitor blocked voltage. If capacitance value increases its capacity also increases which increases efficiency of rectifier.

Q3. What are the different types of filters used for the rectifiers?

Q4. Explain the working principle of Inductive filter.

Q5. Explain the working principle of Capacitive filter.

Q6. Explain the working principle of LC filter.

Q7. Explain the working principle of CLC or π filter.

Q8. What are the advantages of filters?

Q9. What are the disadvantages of filters?

Q10. Draw circuit of HWR with CLC filter.

Q11. Draw circuit of FWR with CLC filter.

Experiment #11
Study of V-I characteristics of DIAC

Q1. What is DIAC?

Ans: A DIAC is a 2-terminal, 3-layer bidirectional device which can be switched from its OFF state to ON state for either polarity of applied voltage.

Q2. What is the difference between DIAC and BJT?

Q3. Draw the symbol of DIAC.

Q4. Explain the working principle of DIAC.

Q5. What are the advantages of DIAC?

Q6. What are the disadvantages of DIAC?

Q7. What are the applications of DIAC?

Q8. The normal way to turn ON a DIAC is by Breakover voltage. Is this true?

Q9. A DIAC is equivalent to a pair of four-layer SCRs. Is this true?

Q10. The DIAC can be constructed in either npn or pnp form. Is this true?

Experiment #12
Study of V-I characteristics of TRIAC

Q1. What is TRIAC?

Ans: A TRIAC is a 3-terminal semiconductor switching device which can control alternating current in a load. TRIAC is an abbreviation for triode AC switch. 'Tri' – indicated that the device has three terminals and 'ac' means that the device controls alternating current or can conduct current in either direction.

Q2. What is the difference between TRIAC and SCR?

Q3. Draw the symbol of TRIAC.

Q4. Draw the SCR Equivalent Circuit of TRIAC.

Q5. Explain the working principle of TRIAC.

Q6. What are the advantages of TRIAC?

Q7. What are the disadvantages of TRIAC?

Q8. What are the applications of TRIAC?

Q9. A TRIAC is a bidirectional switch. Is this true?

Q10. What is the difference between DIAC and TRIAC?