Lecture Plan -1

Semester: **IIIrd** Class:-**ECS** Course Code: **EC-312-F**

Subject:-**Electrical Engineering Materials And Semiconductor Devices** Unit:-**1**

S. No.	Topic: - Introduction To The Syllabus, Review Of Energy Bands And Description Of The Material.	Time Allotted:-
1.	**Introduction** The syllabus comprises seven units. A major portion of the syllabus is related to the semiconductor materials and the semiconductor devices and two units are based upon the dielectric materials and magnetic materials. The conductors, insulator and semiconductors have different energy bands. Semiconductors are the materials which behave like insulator at absolute zero but their resistance decreases with the increase in temp and they behave like conductors at room temperature.	10 min
2	**Division of the Topic** ➢ Introduction to the syllabus ➢ Discrete Energy levels in atomic structure ➢ Conduction and valence bands of insulator ,semi-conductor and conductor	30 min
3.	**Conclusion** --The term conductor is applied to any material that will support a generous flow of Charge when a voltage source of limited magnitude is applied across its terminals. --An insulator is a material that offers a very low level of conductivity when a voltage source is applied. --A semi-conductor is a material that has a conductivity level somewhere between the extremes of the insulator and a conductor. For conductors resistivity (ρ)=10^{-6} Ω-cm For insulators ρ=50 Ω-cm For semiconductors ρ=10^{12} Ω-cm	5 min
4	**Question /Answer** **Q.What is 1 ev?** **Ans.**1ev=1.6x 10^{-19}J **Q.What is the energy gap between the valence band and the conduction band in the conductors?** **Ans.** they are overlapped with each other.	5 min

Assignment to be given:- nil

Reference Readings:- 1 Solid State Electronic Devices: Streetman & Banerjee;Pearson
2. Electronic Devices And Circuits: Milliman's & Halkins; MGH
3. Electronic Devices And Ckt Theory: Boylested & Nashelsky; Pearson

Lecture Plan -2

Semester:- **IIIrd** Class:-**ECS** Course Code:**EC-312-F**

Subject:-**Electrical Engineering Materials And Semiconductor Devices** Unit:-**1**

S. No.	Topic :-DRIFT VELOCITY ,MOBILITY, CONDUCTIVITY	Time Allotted:-
1.	**Introduction** The most important properties of the metals is their high electrical and thermal conductivity. Conductivity of the metals is associated with the presence of the free or 'conduction' electrons. These free electron move throughout the lattice and thus do not belong to a particular atom. Thus metal can be considered as a lattice of positive ion cores held together by means of a gas of electrons.	10 min
2	**Division of the Topic** ➢ Ohm's law ➢ Conductivity of the material ➢ Illustration of the influence of collisions on the velocity of electrons ➢ Mobility	30 min
3.	**Conclusion** One important feature of ohm's law is the fact that current density remains constant in time as long as the E remains constant. Although this is not absolutely correct when we consider the problem of conduction from atomic point of view. From this we have concluded that the free electrons in the conductor must interact with the lattice of positive ions cores and hence they are not completely free.	5 min
4	**Question /Answer** **Q. what is mobility?** **Ans.** it is defined as the magnitude of average drift velocity per unit field. **Q. what will be the effect of increase in temp on the resistivity of the conductors?** **Ans.** resistivity increases with the increase in temp.	5 min

Assignment to be given:- derive the relationship between the drift velocity and the mobility.

Reference Readings:- 1 Solid State Electronic Devices: Streetman & Banerjee;Pearson
2 Electronic Devices And Circuits: Milliman's & Halkins; MGH
3 Electronic Devices And Ckt Theory: Boylested & Nashelsky; Pearson

Lecture Plan -3

Semester:-**IIIrd** Class:-**ECS** Course Code:**EC-312-F**

Subject:-**Electrical Engineering Materials And Semiconductor Devices** Unit:-**1**

S. No.	Topic :-RELAXATION TIME ,COLISION TIME AND MEAN FREE PATH	Time Allotted:-
1.	**Introduction** When we consider the problem of conduction from atomic point of view. From this we have concluded that the free electrons in the conductor must interact with the lattice of positive ions cores and hence they are not completely free. The average time between collisions is called the collision time T_C.	10 min
2	➢ **Division of the Topic** ➢ Relaxation time ➢ Collision time ➢ Relation between relaxation time and collision time ➢ Mean free path ➢ Mean free path in terms of collision time	30 min
3.	**Conclusion** The mean free path of the electron is given by $\lambda=VT_C$ Here λ= mean free path V=total velocity of an electron T_C= average collision time	5 min
4	**Question /Answer** **Q.what is the formula of mobility?** **Ans.** eτ /m **Q. how the relaxation time is related to the collision time?** **Ans.** $T_C=T_C$ **/ (**1-<cosθ >**)**	5 min

Assignment to be given:-

Reference Readings:- 1 Solid State Electronic Devices: Streetman & Banerjee;Pearson
2 Electronic Devices And Circuits: Milliman's & Halkins; MGH
3 Electronic Devices And Ckt Theory: Boylested & Nashelsky; Pearson

Lecture Plan -4

Semester:-**IIIrd** Class:-**ECS** Course Code:**EC-312-F**
Subject:-**Electrical Engineering Materials And Semiconductor Devices** Unit:-**1**

S. No.	Topic :-THERMAL CONDUCTIVITY AND WIEDEMANN –FRANZ LAW	Time Allotted:-
1.	**Introduction** When a homogenous isotropic material is subjected to a temperature gradient, a flow of heat results in the direction opposite to that of the gradient in insulating solids the heat current is carried by lattice vibrations. This is also present in the conducting materials but the thermal conductivity due to the conduction electrons predominates in these materials.	10 min
2	**Division of the Topic** ➢ Thermal conductivity of the metals ➢ Temperature gradient ➢ Specific heat of the electron gas at constant volume. ➢ Effect of temperature on the thermal conductivity. ➢ Wiedemann –franz law	30 min
3.	**Conclusion** There exists an interesting relationship between the electrical conductivity and the thermal conductivity of a metal. The theory predicts that $K/\sigma T$ for all metals should be equal to a universal constant. This law is known as wiedemann –franz law.	5 min
4	**Question /Answer** **Q. what is the value of LORENZ number?** **Ans.** 2.45×10^{-8} watt ohm degree^2 **Q. wiedemann law is applicable for all temp conditions?** **Ans.** it is not applicable at low temperature.	5 min

Assignment to be given:-derive the expression for the thermal conductivity and explain Wiedemann-franz law

Reference Readings:- 1 Solid State Electronic Devices: Streetman & Banerjee;Pearson
2 Electronic Devices And Circuits: Milliman's & Halkins; MGH
3 Electronic Devices And Ckt Theory :Boylested & Nashelsky ; Pearson

Lecture Plan -5

Semester:-**IIIrd** Class:-**ECS** Course Code:**EC-312-F**
Subject:-**Electrical Engineering Materials And Semiconductor Devices** Unit:-**1**

S. No.	Topic : SUPERCONDUCTIVITY AND EFFECT OF MAGNETIC FIELD	Time Allotted:-
1.	**Introduction** Superconductivity was discovered in 1911 by Kamerlingh ones when he observed that the electrical resistivity of mercury disappeared completely at temperature below Approximately 4.2 degrees Kelvin. So a new term is introduced, transition temp. T_c, at which the transition from normal state to the superconducting state occurs.	10 min
2	**Division of the Topic** ➢ Introduction to the superconductivity. ➢ Transition temperature ➢ Reduction in transition temperature by the application of the magnetic field. ➢ Perfect diamagnetism	30 min
3.	**Conclusion** The transition temperature of a superconductor can be reduced by the application of the magnetic field. The transition from the superconducting to the normal state under influence of a magnetic field is reversible. The magnetic field which causes a superconductor to become normal is not necessarily an externally applied field; it may also arise as a result of electric current flow in the conductor. Thus superconductivity in a long circular wire of radius r may be destroyed when the current I exceeds the value Ic. This at the surface of the wire will produce the critical magnetic field Hc.	5 min
4	**Question /Answer** **Q. what is the Silsbee's rule?** **Ans.** Ic=2ΠrHc **Q. good conductors are not good superconductors. True or false?** **Ans.**true	5 min

Assignment to be given:-

Reference Readings:- 1 Solid State Electronic Devices: Streetman & Banerjee;Pearson
2 Electronic Devices And Circuits: Milliman's & Halkins; MGH
3 Electronic Devices And Ckt Theory: Boylested & Nashelsky; Pearson

Lecture Plan -6

Semester:-**IIIrd** Class:-**ECS** Course Code:**EC-312-F**

Subject:-**Electrical Engineering Materials And Semiconductor Devices** Unit:-**1V**

S. No.	**Topic :-REVIEW OF SI AND GE AS SEMICONDUCTOR MATERIALS , CONTINUITY EQUATION**	**Time Allotted:-**
1.	**Introduction** The label semiconductor itself provides a hint as to its characteristics. The prefix semi itself applies to a range midway between two limits . the silicon and germanium are the semiconductor materials. They behave like insulator at absolute zero but their resistivity decreases with the increase in temp.	10 min
2	**Division of the Topic** ➢ Semiconductor material ➢ Single crystal structure of silicon and germanium. ➢ Intrinsic semiconductor materials ➢ Extrinsic semiconductor materials ➢ Effect of temperature on the resistivity of the semiconductors. ➢ Continuity equation	30 min
3.	**Conclusion** An increase in the temperature of the semiconductor can result in a substantial increase in the no. of the free electrons in the material. Semiconductor materials such as Ge or Si show a reduction in resistance with the increase in temperature and therefore they are said to have a negative temperature coefficient.	5 min
4	**Question /Answer** **Q. what are the majority carriers in the N-type semiconductor?** **Ans.** Electrons. **Q. what is the energy gap between the conduction band and the valence band in germanium?** **Ans.** 0.67 ev	5 min

Assignment to be given:-

Reference Readings:- 1 Solid State Electronic Devices: Streetman & Banerjee;Pearson
2 Electronic Devices And Circuits: Milliman's & Halkins; MGH
3 Electronic Devices And Ckt Theory: Boylested & Nashelsky; Pearson

Lecture Plan -7

Semester:-**IIIrd** Class:-**ECS** Course Code:**EC-312-F**

Subject:-**Electrical Engineering Materials And Semiconductor Devices** Unit:-**1V**

S. No.	Topic :-P-N JUNCTION	Time Allotted:-
1.	**Introduction** The pn junction diode is formed by simply bringing these materials together using special techniques. At the instant the two materials are joined together the electrons and holes in the region of the junction will combine resulting in a lack of carriers in the region near the junction. This region of uncovered positive and negative ions is called the depletion region due to depletion of carriers in this region.	10 min
2	**Division of the Topic** ➢ p-n junction diode ➢ --No bias ➢ --forward bias ➢ --reverse bias	30 min
3.	**Conclusion** In the absence of an applied bias voltage , the net flow of charge in any one direction for a semiconductor diode is zero. The current that exists under reverse bias conditions is called the reverse saturation current and it is represented by Is. A semiconductor diode is forward bias when the association p-type and positive & n-type and negative is established.	5 min
4	**Question /Answer** **Q. in the reverse bias condition the reverse saturation current is due to which carriers?** **Ans.** minority carriers **Q. in the forward bias condition what happens to the depletion region?** **Ans.** the width of depletion region decreases.	5 min

Assignment to be given:-

Reference Readings:- 1 Solid State Electronic Devices: Streetman & Banerjee;Pearson
2 Electronic Devices And Circuits: Milliman's & Halkins; MGH
3 Electronic Devices And Ckt Theory :Boylested & Nashelsky ; Pearson

Lecture Plan -8

Semester:-**IIIrd** Class:-**ECS** Course Code:**EC-312-F**

Subject:-**Electrical Engineering Materials And Semiconductor Devices** Unit:-**1V**

S. No.	Topic :- DRIFT AND DIFFUSION	Time Allotted:-
1.	**Introduction** When external voltage is applied to p-n junction diode the movement of electrons & holes is known as diffusion. Flow of electrons & hole due to temp. gradient is known as diffusion	10 min
2	**Division of the Topic** ➢ Diffusion of carriers ➢ Drift of carriers	30 min
3.	**Conclusion** Flow of carriers is due to concentration gradient is known as drift & due to temp. gradient is known as diffusion	5 min
4	**Question /Answer** **Q. in the reverse bias condition the reverse saturation current is due to which carriers?** **Ans.** minority carriers **Q. in the forward bias condition what happens to the depletion region?** **Ans.** the width of depletion region decreases.	5 min

Assignment to be given:-

Reference Readings:- 1 Solid State Electronic Devices: Streetman & Banerjee;Pearson
4 Electronic Devices And Circuits: Milliman's & Halkins; MGH
5 Electronic Devices And Ckt Theory :Boylested & Nashelsky ; Pearson

Lecture Plan -9

Semester:-**IIIrd** Class:-**ECS** Course Code:**EC-312-F**

Subject:-**Electrical Engineering Materials And Semiconductor Devices** Unit:-**1V**

S. No.	Topic :- DIFFUSION AND TRANSITION CAPACITANCE	Time Allotted:-
1.	**Introduction** Electronic devices are sensitive to very high frequencies. Most shunt capacitive effects that can be ignored at lower frequencies because the reactance Xc=1/2πfc is very large (open ckt equivalent). This however can't be ignored at very high frequencies .Xc will become sufficiently small due to the high value of f to introduce a shorting path.	10 min
2	**Division of the Topic** ➢ Effect of frequency on the capacitive reactance ➢ Diffusion capacitance ➢ Transition capacitance	30 min
3.	**Conclusion** The capacitive effects are represented by a capacitor in parallel with the ideal diode. For the low and mid frequency applications the capacitor is not normally included in the diode symbol.	5 min
4	**Question /Answer** **Q. at low frequency the capacitive effects are negligible. TRUE or FALSE?** **Ans.** At low frequency they are negligible because Xc is very large and equivalent to an open ckt. **Q. in which biasing transition capacitance outweighs the diffusion capacitance?** **Ans.** reverse bias region	5 min

Assignment to be given:-

Reference Readings:- 1 Solid State Electronic Devices: Streetman & Banerjee;Pearson
2 Electronic Devices And Circuits: Milliman's & Halkins; MGH
3 Electronic Devices And Ckt Theory: Boylested & Nashelsky; Pearson

Lecture Plan -10

Semester:-**IIIrd** Class:-**ECS** Course Code:**EC-312-F**
Subject:-**Electrical Engineering Materials And Semiconductor Devices** Unit:-**V**

S. No.	Topic :- BREAKDOWN MECHANISM IN P-N JUNCTION DIODE AND ZENER DIODE	Time Allotted:-
1.	**Introduction** In the reverse bias region, there is a point where the application of too negative voltage will result in a sharp change in the characteristics. The current increases at a very rapid rate in a direction opposite to that of the positive voltage region. The reverse bias potential that results in this dramatic change in the characteristics is called the Zener potential. and it is given by Vz.	10 min
2	**Division of the Topic** ➢ breakdown in reverse bias condition ➢ Avalanche breakdown ➢ Zener breakdown ➢ Zener diode	30 min
3.	**Conclusion** The zener region of the semiconductor diode should be avoided. The max reverse bias potential that can be applied to the diode before entering into the zener region is called the peak inverse voltage (referred to PIV**)** Or the peak reverse voltage referred to (PRV)	5 min
4	**Question /Answer** **Q.what is the value of threshold voltage for the silicon?** **Ans.**0.7V **Q. what will be the effect of the increase in temp. on the reverse saturation current ?** **Ans.** it becomes double for every 10 increase in temp.	5 min

Assignment to be given:-

Reference Readings:- 1 Solid State Electronic Devices: Streetman & Banerjee;Pearson
2 Electronic Devices And Circuits: Milliman's & Halkins; MGH
3 Electronic Devices And Ckt Theory: Boylested & Nashelsky; Pearson

Lecture Plan -11

Semester:-**IIIrd** Class:-**ECS** Course Code:**EC-312-F**

Subject:-**Electrical Engineering Materials And Semiconductor Devices** Unit:-**V**

S. No.	Topic :-LED,SOLAR CELL AND PHOTO DETECTORS	Time Allotted:-
1.	**Introduction** The increasing use of the digital display in calculators, watches, and all form of instrumentation has contributed to the current extensive interest in structures that will emit light when properly biased. Solar cells are very frequently used these days. They convert the solar energy into electrical energy The energy transmitted at discrete packages called photons and it is directly proportional to the frequency	10 min
2	**Division of the Topic** ➢ Principle of LED ➢ Construction of LED ➢ Solar cell ➢ Photo diode	30 min
3.	**Conclusion** The two types in common use today to perform this function are the light emitting diode (LED) and the liquid crystal display. Photo diode detectors are used in the alarm system and in the counter operation. Solar cells are becoming very popular as an alternative source of energy but still some new developments are required to maximize the conversion efficiency of the solar cells. The series arrangement of solar cells permits a voltage beyond that of a single element.	5 min
4	**Question /Answer** **Q.what is electroluminescence?** **Ans.**the process of giving off light by applying an electrical source of energy. **Q. what is efficacy?** **Ans.** it is a measure of the ability of the device to produce a desired effect.	5 min

Assignment to be given:-

Reference Readings:- 1 Solid State Electronic Devices: Streetman & Banerjee;Pearson
2 Electronic Devices And Circuits: Milliman's & Halkins; MGH
3 Electronic Devices And Ckt Theory: Boylested & Nashelsky; Pearson

Doc. No.: DCE/0/15
Revision :00

Lecture Plan -12

Semester:-**IIIrd** Class:-**ECS** Course Code:**EC-312-F**

Subject:-**Electrical Engineering Materials And Semiconductor Devices** Unit:-**V**

S. No.	**Topic :- BRIEF INTRODUCTION TO THE PLANER TECHNOLOGY FOR DEVICE FABRICATION.**	**Time Allotted:-**
1.	**Introduction** The techniques applied to the manufacture of semiconductor devices are continually being reviewed, modified and upgraded. In recent years the primary emphasis has been in the yield rate, expanding the automation level and increasing the density level. The sequence of steps in the manufacturing of the discrete units has not changed that dramatically. However the manner in which step is performed has experienced a tremendous change.	10 min
2	**Division of the Topic** ➢ Introduction to planer technology ➢ Basic steps in the planer technology ➢ Zone refining process ➢ Czochralski technique of ic fabrication.	30 min
3.	**Conclusion** Thus, the most important step in ic fabrication is to form the single crystal of germanium or the silicon. The polycrystalline material is first transformed into the molten state by RF induction coils. A single crystal "seed" of the desired impurity level is then immersed in the molten silicon and gradually withdrawn while the shaft holding the seed is slowly turning.	5 min
4	**Question /Answer** **Q. which methods are used for the transistor fabrication?** **Ans.** There are three methods for the transistor fabrication: alloy junction Grown junction Diffusion **Q. what is the function of the oxide layer in the transistor fabrication?** **Ans.** It will reduce the surface leakage current.	5 min

Assignment to be given:

Reference Readings:- 1 Solid State Electronic Devices: Streetman & Banerjee;Pearson
2 Electronic Devices And Circuits: Milliman's & Halkins; MGH
3 Electronic Devices And Ckt Theory: Boylested & Nashelsky; Pearson

Lecture Plan-13

Semester:-**IIIrd** Class:-**ECS** Course Code:**EC-312-F**

Subject:-**Electrical Engineering Materials And Semiconductor Devices** Unit:- **V**

S. No.	Topic :- OHMIC AND NON-OHMIC MATELS IN THE SEMICONDUCTOR JUNCTIONS	Time Allotted:-
1.	**Introduction** As the metals are good conductors of electricity. They allow the current to pass through them. The ohmic metals are those which follow the ohm's law and the non-ohmic resistances are those which don't follow the ohm's law according to which the current flowing in a conductor is directly proportional to the applied voltage provided the current conditions don't change.	10 min
2	**Division of the Topic** ➢ Ohmic and non-ohmic metals ➢ Resistance of semiconductor junctions ➢ The characteristic cure of the semiconductor devices	30 min
3.	**Conclusion** the resistance of the semiconductor junction doesn't follow the ohm's law as most of the metals do. There is non-linear relationship between the current and the voltage.	5 min
4	**Question /Answer** **Q. what are the non-ohmic resistance?** **Ans.** the materials which don't follow the ohm's law are called the non-ohmic resistance. **Q. what is positive temperature coefficient?** **Ans.** Metals have the positive temperature coefficient. The resistance increases with the increase temperature.	5 min

Assignment to be given:-

Reference Readings:- 1 Solid State Electronic Devices: Streetman & Banerjee;Pearson
2 Electronic Devices And Circuits: Milliman's & Halkins; MGH
3 Electronic Devices And Ckt Theory: Boylested & Nashelsky; Pearson

Doc. No.: DCE/0/15
Revision :00

Lecture Plan -14

Semester:-**IIIrd** Class:-**ECS** Course Code:**EC-312-F**

Subject:-**Electrical Engineering Materials And Semiconductor Devices** Unit:-**VI**

S. No.	Topic :-Introduction ,working of BJT	Time Allotted:-
1.	**Introduction** UPTO 1947, the vacuum tubes were used in all the electronic devices. but after the discovery of transistor ,the advantages of this three terminal solid state device over the vacuum tubes were quite obvious, it was smaller, lightweight ,no heat requirements, less power absorption. Any many more.	10 min
2	**Division of the Topic** ➢ Introduction to transistor ➢ Transistor construction ➢ Transistor operation. ➢ Common base configuration ➢ Common emitter configuration ➢ Common collector configuration	30 min
3.	**Conclusion** For each transistor there is a region of operation on the characteristics which will ensure that the max. Ratings are not being exceeded and the output signal exhibits minimum distortion. These are defined by the manufacturer on the specification sheets. These specification sheets are the communication links between the user and the manufacturer. but it is important that the information provided must be recognized and correctly understood	5 min
4	**Question /Answer** **Q. what is the biasing in the cut-off region in common base configuration?** **Ans.** The collector –base and base- emitter junctions are both reverse biased**..** **Q. what is the value of V_{BE} In the saturation region?** **Ans**. 0.7 V	5 min

Assignment to be given:-

Reference Readings:- 1 Solid State Electronic Devices: Streetman & Banerjee;Pearson
2 Electronic Devices And Circuits: Milliman's & Halkins; MGH
3 Electronic Devices And Ckt Theory: Boylested & Nashelsky; Pearson

Lecture Plan -15

Semester:-**IIIrd** Class:-**ECS** Course Code:**EC-312-F**

Subject:-**Electrical Engineering Materials And Semiconductor Devices** Unit:-**VI**

S. No.	Topic :-configuration & characteristics of BJT	Time Allotted:-
1.	**Introduction** Depending on which terminal is made common BJT is used in three configuration. CE,CB,CC	10 min
2	**Division of the Topic** . ➢ Common base configuration ➢ Common emitter configuration ➢ Common collector configuration	30 min
3.	**Conclusion** Transistor is used as an amplifier in CE configuration because of high current gain Transistor is used as voltage buffer in CC configuration because of unity voltage gain	5 min
4	**Question /Answer** **Q.** Transistor is used as an amplifier in which region? Ans: active region **Q. what is emitter follower?** **Ans.** Transistor in CC configuration is known as emitter follower	5 min

Assignment to be given:-

Reference Readings:- 1 Solid State Electronic Devices: Streetman & Banerjee;Pearson
5 Electronic Devices And Circuits: Milliman's & Halkins; MGH
6 Electronic Devices And Ckt Theory: Boylested & Nashelsky; Pearson

Doc. No.: DCE/0/15
Revision :00

Lecture Plan -16

Semester:-**IIIrd** Class:-**ECS** Course Code:**EC-312-F**
Subject:-**Electrical Engineering Materials And Semiconductor Devices** Unit:-**VI**

S. No.	Topic :- WORKING AND CHARACTRISTICS OF UJT	Time Allotted:-
1.	**Introduction** The UJT is a three terminal device. A slab of lightly doped n-type silicon material has two base contacts attaches to both ends of one surface and an aluminum rod alloyed to the opposite surface. The p-n junction of the device is formed at the boundary of the aluminum rod and the n-type silicon slab.	10 min
2	**Division of the Topic** ➢ Introduction to the UJT ➢ PEAK POINT ➢ VALLEY POINT ➢ UJT triggering of an SCR.	30 min
3.	**Conclusion** The common application of UJT is to trigger the some devices such as the SCR. In the UJT, the single p-n junction accounts for the terminology uni- junction. It was originally called a duo base diode due to the presence of two base contacts.	5 min
4	**Question /Answer** **Q.WHAT IS VALLEY POINT?** **Ans.**.the voltage is min and any further increase in the current will place the device in the saturation **Q. What is the power dissipation the UJT?** **Ans.**it is 300mw	5 min

Assignment to be given:-

Reference Readings:- 1 Solid State Electronic Devices: Streetman & Banerjee;Pearson
2 Electronic Devices And Circuits: Milliman's & Halkins; MGH
3 Electronic Devices And Ckt Theory: Boylested & Nashelsky; Pearson

Doc. No.: DCE/0/15
Revision :00

Lecture Plan -17

Semester:-**IIIrd** Class:-**ECS** Course Code:**EC-312-F**

Subject:-**Electrical Engineering Materials And Semiconductor Devices** Unit:-**VI**

S. No.	Topic :- WORKING AND CHARACTERISTICS OF JFET.	Time Allotted:-
1.	**Introduction** Field effect transistor amplifiers provide an excellent voltage gain with the added feature of a high input resistance. They are also considered low power consumption with good frequency range.Fet is a voltage controlled device	10 min
2	**Division of the Topic** ➢ Introduction to the JFET ➢ Characteristics of JFET ➢ Field bias configuration ➢ Self bias configuration ➢ Voltage divider configuration ➢ Source follower configuration ➢ Common gate configuration.	30 min
3.	**Conclusion** The JFET can be used as a linear amplifier or as a digital device in logic circuits. it is use widely n buffering applications and the output impedance f a jfet is same as that of a conventional BJT.	5 min
4	**Question /Answer** **Q. What is the practical value of input resistance in jfet?** **Ans.** $10^9\ \Omega$ **Q. Is the practical value of output resistance of jfet is different from that of BJT?** **Ans. NO** they are practically same.	5 min

Assignment to be given:-

Reference Readings:- 1 Solid State Electronic Devices: Streetman & Banerjee;Pearson
2 Electronic Devices And Circuits: Milliman's & Halkins; MGH
3 Electronic Devices And Ckt Theory: Boylested & Nashelsky; Pearson

Doc. No.: DCE/0/15
Revision :00

Lecture Plan -18

Semester:-**IIIrd** Class:-**ECS** Course Code:**EC-312-F**

Subject:-**Electrical Engineering Materials And Semiconductor Devices** Unit:-**VI**

S. No.	Topic :- CONSTRUCTION AND WORKING OF MOSFET	Time Allotted:-
1.	**Introduction** The label mosfet stands for the metal –oxide-semiconductor-field-effect-transistor. There are two types of mosfet. Depletion type and the enhancement type mosfet. These are different in the characteristics and the operations.	10 min
2	**Division of the Topic** ➢ Introduction to MOSFET ➢ Basic construction and the operation of the DEPLETION TYPE MOSFETS. ➢ Basic construction and the operation of the ENHANCEMENT TYPE MOSFETS. First two topics are covered in this lecture	30 min
3.	**Conclusion** Although there are some similarities in construction and mode of operation between the depletion type and the enhancement type MOSFET..The characteristics of the enhancement type mosfet are quite different from the depletion type MOSFET.	5 min
4	**Question /Answer** **Q.What is the purpose of the SiO_2 in depletion type mosfets?** **Ans.**.it sets up an opposing electric field within the dielectric when exposed to the externally applied field. **Q. What is the main cause of the high input impedance in the depletion type mosfet?** **Ans.SiO_2.**	5 min

Assignment to be given:-

Reference Readings:- 1 Solid State Electronic Devices: Streetman & Banerjee;Pearson
2 Electronic Devices And Circuits: Milliman's & Halkins; MGH
3 Electronic Devices And Ckt Theory: Boylested & Nashelsky; Pearson

Lecture Plan -19

Semester:-**IIIrd** Class:-**ECS** Course Code:**EC-312-F**

Subject:-**Electrical Engineering Materials And Semiconductor Devices** Unit:-**VI**

S. No.	Topic :- CONSTRUCTION AND WORKING OF MOSFET (CONTINUED)	Time Allotted:-
1.	**Introduction** The label mosfet stands for the metal –oxide-semiconductor-field-effect-transistor. There are two types of mosfet. Depletion type and the enhancement type mosfet. These are different in the characteristics and the operations.	10 min
2	**Division of the Topic** . ➢ Basic construction and the operation of the ENHANCEMENT TYPE MOSFETS. ➢ N- channel & p-channel EMOSFET	30 min
3.	**Conclusion** Although there are some similarities in construction and mode of operation between the depletion type and the enhancement type MOSFET..The characteristics of the enhancement type mosfet are quite different from the depletion type MOSFET.	5 min
4	**Question /Answer** **Q.What is the purpose of the SiO_2 in depletion type mosfets?** **Ans.**.it sets up an opposing electric field within the dielectric when exposed to the externally applied field. **Q. What is the main cause of the high input impedance in the depletion type mosfet?** **Ans.SiO_2.**	5 min

Assignment to be given:-

Reference Readings:- 1 Solid State Electronic Devices: Streetman & Banerjee;Pearson
4 Electronic Devices And Circuits: Milliman's & Halkins; MGH
3 Electronic Devices And Ckt Theory: Boylested & Nashelsky; Pearson

Lecture Plan -20

Semester:-**IIIrd** Class:-**ECS**Course Code:**EC-312-F**

Subject:-**Electrical Engineering Materials And Semiconductor Devices** Unit:-**VI**

S. No.	Topic :- CHARACTERISTICS OF MOSFET	Time Allotted: -
1.	**Introduction** SCHOTTKY equation will continue to be applicable for depletion type mosfet characteristics in both the depletion and the enhancement type regions. In both the regions it is necessary that the proper sign is to be included with V_{GS} in the equation and the sign be carefully monitored in the mathematical operations.	10 min
2	**Division of the Topic** ➢ Characteristics of depletion type MOSFET:depletion mode • Enhancement mode ➢ Characteristics of the enhancement type MOSFET:DRAIN CHARATERISTICS • TRANSFER CHARACTERISTICS	30 min
3.	**Conclusion** The region of the positive gate voltage s on the drain or the transfer characteristics is often referred as the enhancement region , with the region between the cut-off and the saturation level of I_{DSS} referred to as the depletion region.	5 min
4	**Question /Answer** **Q.Which three pins are present in the depletion type mosfet?** **Ans.** Gate, drain and source. **Q. How many pins are present in the enhancement type mosfet /** **Ans.** Four pins.	5 min

Assignment to be given:-

Reference Readings:- 1 Solid State Electronic Devices: Streetman & Banerjee;Pearson
2 Electronic Devices And Circuits: Milliman's & Halkins; MGH
3 Electronic Devices And Ckt Theory: Boylested & Nashelsky; Pearson

Lecture Plan-21

Semester:-**IIIrd** Class:-**ECS** Course Code:**EC-312-F**

Subject:-**Electrical Engineering Materials And Semiconductor Devices** Unit:-**VII**

S. No.	Topic :- THYRISTOR	Time Allotted:-
1.	**Introduction** The thyristor has the characteristics similar to the thyratron tube. But from the construction view point, a thyristor (a pnpn device) belongs to transistor (pnp or npn device) family. The name thyristor is derived from the combination of the capital letters from the THYRatron and transistor. This means that the thyristor is a solid state device like a transistor and has the characteristics similar to that of a thyratron tube.	10 min
2	**Division of the Topic** ➢ Introduction to the thyristor ➢ Terminal characteristics of thyristor ➢ Static V-I characteristics of thyristors ➢ Switching characteristics of thyristor	30 min
3.	**Conclusion** Thyristor is a four layers, three junction, p-n-p-n semiconductor switching device. It has three terminals anode, cathode and gate. For engineering applications of the thyristor, their terminal characteristics should be known. For economical and the reliable design of convector equipments the static and the switching characteristics of the thyristor are very important.	5 min
4	**Question /Answer** **Q.How many p-n junctions are present in the thyristor?** **Ans.**3 **Q. When anode is positive with respect to the cathode in an SCR , the number of blocked p-n junctions is ?** **Ans.** 1	5 min

Assignment to be given:-

Reference Readings:- 1 Solid State Electronic Devices: Streetman & Banerjee;Pearson
2 Electronic Devices And Circuits: Milliman's & Halkins; MGH
3 Electronic Devices And Ckt Theory: Boylested & Nashelsky; Pearson

Doc. No.: DCE/0/15
Revision :00

Lecture Plan -22

Semester:-**IIIrd** Class:-**ECS** Course Code:**EC-312-F**

Subject:-**Electrical Engineering Materials And Semiconductor Devices** Unit:-**VII**

S. No.	Topic :- DIAC	Time Allotted:-
1.	**Introduction** The DIAC is an important member of thyristor family and usually employed for triggering TRIAC. A DIAC is a two-electrode bi-directional avalanche diode which can be switched from off-state to the on-state for either polarity of the applied voltage. Its equivalent ckt is a pair of inverted four layer diodes.	10 min
2	**Division of the Topic** ➢ Introduction to diac ➢ Construction of diac ➢ Operation of diac ➢ V-I characteristics of diac ➢ Applications of diac	30 min
3.	**Conclusion** The diacs because of their symmetrical bidirectional switching characteristics are widely used as the triggering devices in the triac phase control ckt employed for lamp dimmer, heat control, universal motor speed control.	5 min
4	**Question /Answer** **Q.To which family the diac belongs?** **Ans.** Thyristor family. **Q. What is diac?** **Ans.** A diac is a p-n-p-n structured four-layer, two terminal semiconductor device . diode has been derived from the diode that can work on AC.	5 min

Assignment to be given:-

Reference Readings:- 1 Solid State Electronic Devices: Streetman & Banerjee;Pearson
2 Electronic Devices And Circuits: Milliman's & Halkins; MGH

3 Electronic Devices And Ckt Theory: Boylested & Nashelsky; Pearson

Doc. No.: DCE/0/15
Revision :00

Lecture Plan -23

Semester:-**IIIrd** Class:-**ECS** Course Code:**EC-312-F**

Subject:-**Electrical Engineering Materials And Semiconductor Devices** Unit:-**VII**

S. No.	Topic :-TRIAC	Time Allotted:-
1.	**Introduction** TRIAC is an abbreviation for three terminal ac switches. "TRI" indicates that the device has three terminals and "AC" indicates that the device controls ac current or can conduct in either direction. Due to its bidirectional conduction property the triac is used in the field of power electronics for control purposes.	10 min
2	**Division of the Topic** ➢ Introduction to triac ➢ Constructional details of triac ➢ Operation of triac ➢ Characteristics of triac ➢ Applications of triac	30 min
3.	**Conclusion** Next to SCR, the triac is the most widely used member of the thyristor family. in fact, in many of control applications it has replaced SCR by virtue of the bidirectional conductivity. Motor speed regulation, temperature control, illumination control, liquid level control, phase control ckt , power switches are some of its main applications.	5 min
4	**Question /Answer** **Q. what is triac?** **Ans.** The triac is a three terminal, four layer, bidirectional semiconductor device. It incorporates two SCRs connected in inverse parallel with a common gate terminal in a single chip. . **Q. How many triggering modes are present in the V-I characteristics of triac?** **Ans.** four	5 min

Assignment to be given:-

Reference Readings:- 1 Solid State Electronic Devices: Streetman & Banerjee;Pearson
2 Electronic Devices And Circuits: Milliman's & Halkins; MGH
3 Electronic Devices And Ckt Theory: Boylested & Nashelsky; Pearson

Doc. No.: DCE/0/15
Revision :00

Lecture Plan -24

Semester:-**IIIrd** Class:-**ECS** Course Code:**EC-312-F**

Subject:-**Electrical Engineering Materials And Semiconductor Devices** Unit:-**VII**

S. No.	Topic :- GTO	Time Allotted:-
1.	**Introduction** A gate turn off thyristor (GTO) is a special thyristor which can be turned on by a positive gate signal and can be turned off by a negative gate signal. Evidently the use of a GTO in electronic ckt eliminates the need of the forced communication ckt because turn off is achieved by applying a negative gate signal.	10 min
2	**Division of the Topic** ➢ Introduction to GTO ➢ Two thyristor analogy of GTO ➢ Characteristics of GTO ➢ Advantages of GTO over the thyristor ➢ Disadvantages of GTO as compare to thyristor	30 min
3.	**Conclusion** **GTO** has many advantages over the thyristors like fast switching speed higher efficiency because the losses in the commutation system are eliminated. Circuit using GTO are more compact as compare to thyristor ckt. But still it has some disadvantages like higher latching and holding ckt, higher gate current, higher gate ckt losses, lower reverse voltage blocking capability.	5 min
4	**Question /Answer** **Q.A GTO can be turned off by a positive gate pulse. Is it true?** **Ans.**false, it is turned off by a negative gate pulse. **Q. What is the value of I_A before initiation of the conduction?** **Ans I**t is zero	5 min

Assignment to be given:-

Reference Readings:- 1 Solid State Electronic Devices: Streetman & Banerjee;Pearson
2 Electronic Devices And Circuits: Milliman's & Halkins; MGH
3 Electronic Devices And Ckt Theory: Boylested & Nashelsky; Pearson

Doc. No.: DCE/0/15
Revision :00

Lecture Plan -25

Semester:-**IIIrd** Class:-**ECS** Course Code:**EC-312-F**

Subject:-**Electrical Engineering Materials And Semiconductor Devices** Unit:-**VII**

S. No.	Topic :-IGBT	Time Allotted:-
1.	**Introduction** INSULATED GATE BIPOLAR TRANSISTOR (IGBT) is a new high conductance MOS gate controlled power switch. The fabrication process is similar to that of an N-channel power MOSFET but employs an N- epitaxial layer grown on a P+ substrate. In operation the apitaxial region is conductivity modulated by excess holes and electrons thereby eliminating the major component of the on-resistance.	10 min
2	**Division of the Topic** ➢ Introduction to IGBT ➢ Structure of IGBT ➢ Equivalent ckt of IGBT ➢ Device operation and characteristics ➢ Transient response measurement ➢ Handling precautions for IGBT	30 min
3.	**Conclusion** In the case of IGBT the on-resistance values has been reduced by a factor of about 10 compared with those of conventional n-channel power MOSFET of comparable size and voltage capability. It is used In high voltage applications. Now a day the improved IGBT with fast switching speed and high current capability are also available.	5 min
4	**Question /Answer** **Q.How many layers are present in IGBT?** **Ans.**FOUR LAYERS **Q. What is the offset voltage?** **Ans** -0.7 V.	5 min

Assignment to be given:-

Reference Readings:- 1 Solid State Electronic Devices: Streetman & Banerjee;Pearson
2 Electronic Devices And Circuits: Milliman's & Halkins; MGH

Lecture Plan -26

Semester:-**IIIrd** Class:-**ECS** Course Code:**EC-312-F**

Subject:-**Electrical Engineering Materials And Semiconductor Devices** Unit:-**VII**

S. No.	Topic :- VMOS	Time Allotted:-
1.	**Introduction** One of the disadvantages of the typical MOSFET is the reduced power handling levels (typically less than 1w) compared to BJT transistor. This shortfall for a device with so many positive characteristics can be softened by changing the construction mode from one of a planer nature .	10 min
2	**Division of the Topic** ➢ Introduction to VMOS ➢ VMOS construction ➢ Characteristics of VMOS	30 min
3.	**Conclusion** Compared with commercially available planer MOSFETs; VMOS FETs have reduced channel resistance levels and higher current and power ratings. Along with this the reduced charge storage levels result in faster switching times for VMOS construction compared to those for conventional planer construction.	5 min
4	**Question /Answer** **Q.What do you mean by VMOS?** **Ans.**VERTICAL METAL OXIDE SILICON (VMOS)FET **Q. What is significance of "vertical" term in VMOS?** **Ans** because the channel is now formed in the vertical direction rather than the horizontal direction for the planer device.	5 min

Assignment to be given:-

Reference Readings:- 1 Solid State Electronic Devices: Streetman & Banerjee;Pearson
2 Electronic Devices And Circuits: Milliman's & Halkins; MGH
3 Electronic Devices And Ckt Theory: Boylested & Nashelsky; Pearson

Lecture Plan -27

Semester:-**IIIrd** Class:-**ECS** Course Code:**EC-312-F**

Subject:-**Electrical Engineering Materials And Semiconductor Devices** Unit:-**II**

S. No.	Topic :- INTRODUCTION TO THE DIELECTRIC MATERIALS, BEHAVIOR OF DIELECTRIC IN STATIC ELECTRIC FIELD	Time Allotted:-
1.	**Introduction** Electrical insulators have very few electrons to take part in normal conductivity. Such materials have interesting electrical properties because the applied electric field creates electric dipole. And the material becomes polarized. Materials in which polarization effect are important are called dielectric. This topic deals with the properties of the dielectric when they are subjected to the external static electric field.	10 min
2	**Division of the Topic** ➢ Introduction to the dielectric materials ➢ Basic results of electrostatic ➢ Dielectric slab of thickness d is subjected to an applied static electric field.	30 min
3.	**Conclusion** In the dielectric material the bound electrons are predominant (in conductors the free electrons are in abundance) under the application of an external electric field, the bound electrons of an atom are displaced such that the centroid of the electronic cloud is separated from the centroid of the nuclear. the atom is then said to be polarized thereby creating an electric dipole. This phenomenon is called the electronic polarization.	5 min
4	**Question /Answer** **Q.How will you define the dipole moment?** **Ans.**dipole moment is a vector pointing from the negative charge to the positive charge. **Q. what is the unit of electric susceptibility?** **Ans.** It is a dimensionless parameter.	5 min

Assignment to be given:-

Reference Readings:- 1 Solid State Electronic Devices: Streetman & Banerjee;Pearson
2 Electronic Devices And Circuits: Milliman's & Halkins; MGH
3 Electronic Devices And Ckt Theory: Boylested & Nashelsky; Pearson

Doc. No.: DCE/0/15
Revision :00

Lecture Plan -28

Semester:-**IIIrd** Class:-**ECS** Course Code:**EC-312-F**

Subject:-**Electrical Engineering Materials And Semiconductor Devices** Unit:-**II**

S. No.	Topic :- DIELECTRIC PARAMETERS	Time Allotted:-
1.	**Introduction** There are various parameters associated with dielectric such as. dielectric constant, Dipole moment, Polarization ,Electric susceptibility	10 min
2	**Division of the Topic** ➢ **Dielectric parameters:** dielectric constant • Dipole moment • Polarization • Electric susceptibility	30 min
3.	**Conclusion** In the dielectric material the bound electrons are predominant (in conductors the free electrons are in abundance) under the application of an external electric field, the bound electrons of an atom are displaced such that the centroid of the electronic cloud is separated from the centroid of the nuclear. the atom is then said to be polarized thereby creating an electric dipole. This phenomenon is called the electronic polarization.	5 min
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Assignment to be given:-

Reference Readings:- 1 Solid State Electronic Devices: Streetman & Banerjee;Pearson
2 Electronic Devices And Circuits: Milliman's & Halkins; MGH

Doc. No.: DCE/0/15
Revision :00

Lecture Plan -29

Semester:-**IIIrd** Class:-**ECS** Course Code:**EC-312-F**

Subject:-**Electrical Engineering Materials And Semiconductor Devices** Unit:-**1I**

S. No.	Topic :- MECHANISMS OF POLARISATION	Time Allotted:-
1.	**Introduction** In dielectric materials ,all electrons are bound; the only motion possible in the presence of an electric field is a minute displacement of positive and negative charges In opposite directions. The displacement is usually small compared to atomic dimensions. A dielectric in which this displacement takes place is said to be polarized. And its molecules are said to possess induced dipole moments. These dipoles produce their own field which adds to that of the external field.	10 min
2	**Division of the Topic** Polarization ➢ Basic polarization mechanism: electronic or induced polarization ➢ Ionic polarization ➢ Oriental polarization ➢ interfacial or space charge polarization	30 min
3.	**Conclusion** Distribution of electrons in both atoms and molecules is almost completely independent of temperature, so both electronic ionic polarization are independent of temperature.	5 min
4	**Question /Answer** **Q. In what type of materials the ionic polarization is found?** **Ans.**ionic compound **Q. What is the name given to the solids which exhibit only electronic polarizability?** **Ans.** elemental solid dielectrics.	5 min

Assignment to be given:-

Reference Readings:- 1 Solid State Electronic Devices: Streetman & Banerjee;Pearson
2 Electronic Devices And Circuits: Milliman's & Halkins; MGH
3 Electronic Devices And Ckt Theory: Boylested & Nashelsky; Pearson

Lecture Plan -30

Semester:-**IIIrd** Class:-**ECS** Course Code:**EC-312-F**

Subject:-**Electrical Engineering Materials And Semiconductor Devices** Unit:-**1I**

S. No.	Topic :- TYPES OF DIELECTRIC MATERIALS AND THEIR STATIC DIELECTRIC CONSTANT.	Time Allotted:-
1.	**Introduction** The dielectric polarization is considered to arise from the three major sources: electronic, ionic, oriental polarization. This provides a mean for differentiating among various important groups of dielectric materials. Three classes of materials may be identified : Elemental solid dielectric Ionic non-polar solid dielectric Polar solids.	10 min
2	**Division of the Topic** Introduction to the basis of classification of different materials Dielectric constant of: ➢ Elemental ➢ ionic non-polar ➢ polar solid dielectric	30 min
3.	**Conclusion** Elemental solid dielectrics are the materials consisting of single type of atoms such as diamond. In ionic crystal such as alkali halides, the total polarization is electronic and ionic in nature. In solids whose molecules posses' permanent dipole moment, the total polarization has all the three components and these are called the polar solids.	5 min
4	**Question /Answer** **Q.Which type of polarization does the polar solids exhibit?** **Ans.** all the three. **Q. Give the example of ferroelectric alum?** **Ans** ammonium iron alum	5 min

Assignment to be given:-

Reference Readings:- 1 Solid State Electronic Devices: Streetman & Banerjee;Pearson
2 Electronic Devices And Circuits: Milliman's & Halkins; MGH
3 Electronic Devices And Ckt Theory: Boylested & Nashelsky; Pearson

Lecture Plan -31

Semester:-**IIIrd** Class:-**ECS** Course Code:**EC-312-F**
Subject:-**Electrical Engineering Materials And Semiconductor Devices** Unit:-**1I**

S. No.	Topic :-PIEZOELECTRIC , PYROELECTRIC,FERROELECTRIC MATERIALS AND THEIR APPLICATIONS	Time Allotted:-
1.	**Introduction** Piezoelectric materials become electrically polarized in response to an applied mechanical stress. A pyroelectric material is one which exhibits a spontaneous polarization in the absence of an electric field and changes its polarization upon heating. A ferroelectric material is one which exhibit a spontaneous polarization the absence of an electric field which may be switched in direction by the application of a field.	10 min
2	**Division of the Topic** ➢ Piezoelectricity ➢ Pyroelectricity ➢ Ferroelctricity ➢ Ferroelectric materials and their properties ➢ Classification of the ferroelectric material	30 min
3.	**Conclusion** All ferroelectrics are pyroelectric and piezoelectric. All pyroelectrics are piezoelectric, but the converse is not true. All piezoelectric are not pyroelectrics and all pyroelectrics are not ferroelectrics.	5 min
4	**Question /Answer** **Q. How the value of dielectric constant can be changed?** **Ans.** By the change in the direction and magnitude of the of electric field. **Q. in which field the very thin ferroelectric crystals are used?** **Ans** For compute memories.	5 min

Assignment to be given:-

Reference Readings:- 1 Solid State Electronic Devices: Streetman & Banerjee;Pearson
2 Electronic Devices And Circuits: Milliman's & Halkins; MGH
3 Electronic Devices And Ckt Theory: Boylested & Nashelsky; Pearson

Doc. No.: DCE/0/15
Revision :00

Lecture Plan -32

Semester:-**IIIrd** Class:-**ECS** Course Code:**EC-312-F**

Subject:-**Electrical Engineering Materials And Semiconductor Devices** Unit:-**1I**

S. No.	Topic :-BEHAVIOR IN ALTERNATING FIELD AND POLARIZABILITY	Time Allotted:-
1.	**Introduction** When an alternating field is applied to a dielectric , there exists a phase lag between the applied field and the instantaneous polarization , and the relative permittivity is expressed in terms of real and imaginary parts. Debye equations give the in phase and out of phase components of dielectric constant as a function of frequency. The imaginary part of the dielectric constant is responsible for dielectric loss in dielectric materials.	10 min
2	**Division of the Topic** ➢ Complex permittivity. ➢ Frequency response of the dielectric constant of solids. ➢ Electronic polarizability ➢ Frequency dependence of ionic polarization ➢ Frequency dependence of orientational polarization..	30 min
3.	**Conclusion** Polarization P resulting from the applied alternating field, in general differs in phase from E .this is due to the inertia of polarization., which when the frequency becomes high enough, cannot follow the field variations, giving rise to relaxation of measured dielectric constant.	5 min
4	**Question /Answer** **Q.Name the different types of polarization?** **Ans.**.Electronic, ionic and orientational. **Q. IN which region the resonance frequency of the electronic polariability lies?** **Ans** ultraviolet part of the electromagnetic spectrum.	5 min

Assignment to be given:-

Reference Readings:- 1 Solid State Electronic Devices: Streetman & Banerjee;Pearson

2 Electronic Devices And Circuits: Milliman's & Halkins; MGH

3 Electronic Devices And Ckt Theory: Boylested & Nashelsky; Pearson

Doc. No.: DCE/0/15
Revision :00

Lecture Plan -33

Semester:-**IIIrd** Class:-**ECS** Course Code:**EC-312-F**
Subject:-**Electrical Engineering Materials And Semiconductor Devices** Unit:-**1I**

S. No.	Topic :- DIELECTRIC LOSSES AND LOSS TANGENT	Time Allotted:-
1.	**Introduction** Electronic, ionic and orientational polarization lead to a complex dielectric constant when a dielectric is subjected to an alternating field. The dielectric constant has real and imaginary parts and incorporates all the contributions of polarization.	10 min
2	**Division of the Topic** ➢ Dielectric loss ➢ Loss tangent ➢ Phasor representation of the in phase and out of phase components of current ➢ Dielectric loss angle ➢ Concept of dissipation factor	30 min
3.	**Conclusion** Imaginary part of the dielectric constant gives rise to the absorption of energy by the material from the alternating field. it is customary to characterize the dielectric losses at a certain frequency and temperature by a factor called the loss tangent, tan δ.	5 min
4	**Question /Answer** **Q.What is the leading angle of current to the applied field?** **Ans.** (90-δ). **Q. What is the range for the value of tanδ?** **Ans** 0.0001 to 0.001	5 min

Assignment to be given:-

Reference Readings:- 1 Solid State Electronic Devices: Streetman & Banerjee;Pearson
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Doc. No.: DCE/0/15
Revision :00

Lecture Plan -34

Semester:-**IIIrd** Class:-**ECS** Course Code:**EC-312-F**

Subject:-**Electrical Engineering Materials And Semiconductor Devices** Unit:-**1II**

S. No.	Topic :- INTRODUCTION TO THE MAGNETIC PROPERTIES OF THE MAGNETISM AND PERMEABILITY AND MAGNETIC SUSCEPTIBILITY	Time Allotted:-
1.	**Introduction** The materials which can be magnetized are called the magnetic materials . all materials show some magnetic field . in many substances the effect are so weak that the materials are generally considered to be non-magnetic .however only a vacuum is the truly non-magnetic medium. Magnetic materials can be classified on the basis of their application and the other according to their behavior.	10 min
2	**Division of the Topic** ➢ Introduction to the magnetic materials ➢ Basic results of field theory ➢ Permeability ➢ Magnetic susceptibility ➢ Magnetic dipole ➢ Magnetization Above three topics are covered in this lecture	30 min
3.	**Conclusion** Many characteristics of the magnetic materials are similar to that of the dielectric materials. Atoms and molecules give rise to the magnetic dipole moments similar to electric dipole moments. Some magnetic materials exhibit spontaneous magnetization just like spontaneous polarization in the dielectrics.	5 min
4	**Question /Answer** **Q.what is the dimension of relative permeability?** **Ans.**. it is a dimensionless quantity. **Q. how will you define the magnetic susceptibility?** **Ans.** It is magnetization per unit volume and is a pure no.	5 min

Assignment to be given:-

Reference Readings:- 1 Solid State Electronic Devices: Streetman & Banerjee;Pearson
2 Electronic Devices And Circuits: Milliman's & Halkins; MGH
3 Electronic Devices And Ckt Theory: Boylested & Nashelsky; Pearson

Doc. No.: DCE/0/15
Revision :00

Lecture Plan -35

Semester:-**IIIrd** Class:-**ECS** Course Code:**EC-312-F**

Subject:-**Electrical Engineering Materials And Semiconductor Devices** Unit:-**1II**

S. No.	**Topic :- INTRODUCTION TO THE MAGNETIC PROPERTIES OF THE MAGNETISM AND PERMEABILITY AND MAGNETIC SUSCEPTIBILITY (CONTINUED)**	**Time Allotted:-**
1.	**Introduction** The materials which can be magnetized are called the magnetic materials . all materials show some magnetic field . in many substances the effect are so weak that the materials are generally considered to be non-magnetic .however only a vacuum is the truly non-magnetic medium. Magnetic materials can be classified on the basis of their application and the other according to their behavior.	10 min
2	**Division of the Topic** ➢ Magnetic susceptibility ➢ Magnetic dipole ➢ Magnetization	30 min
3.	**Conclusion** Many characteristics of the magnetic materials are similar to that of the dielectric materials. Atoms and molecules give rise to the magnetic dipole moments similar to electric dipole moments. Some magnetic materials exhibit spontaneous magnetization just like spontaneous polarization in the dielectrics.	5 min
4	**Question /Answer** **Q.what is the dimension of relative permeability?** **Ans.**. it is a dimensionless quantity. **Q. how will you define the magnetic susceptibility?** **Ans.** It is magnetization per unit volume and is a pure no.	5 min

Assignment to be given:-

Reference Readings:- 1 Solid State Electronic Devices: Streetman & Banerjee;Pearson
4 Electronic Devices And Circuits: Milliman's & Halkins; MGH
5 Electronic Devices And Ckt Theory: Boylested & Nashelsky; Pearson

Lecture Plan-36

Semester:-**IIIrd** Class:-**ECS** Course Code:**EC-312-F**
Subject:-**Electrical Engineering Materials And Semiconductor Devices** Unit:-**1II**

S. No.	Topic :- CLASSIFICATION OF THE MAGNETIC MATERIALS	Time Allotted:-
1.	**Introduction** With respect to their magnetic behavior the materials may be classified as diamagnetic, paramagnetic, ferromagnetic, antiferromagnetic and ferromagnetic. The manifestation of the magnetic behavior may be attributed to electron orbital motion, to electron spin and to nuclear spin.	10 min
2	**Division of the Topic** ➢ Introduction to the magnetic behavior of the materials ➢ Diamagnetism ➢ Origin of permanent magnetic dipole moment ➢ Para magnetism ➢ Ferromagnetism ➢ Weiss theory of ferromagnetism.	30 min
3.	**Conclusion** Diamagnetism has its origin in the circular charges in the orbits and hence all the materials exhibit diamagnetism. On the other hand only those materials which posses permanent magnetic dipoles can be paramagnetic, ferromagnetic. Antiferromagnetic or ferromagnetic.	5 min
4	**Question /Answer** **Q.give the examples of ferromagnetic materials?** **Ans.**iron, cobalt and nickel **Q. how does the susceptibility depends upon the temp. for the diamagnetic materials?** **Ans** susceptibility is independent of temperature.	5 min

Assignment to be given:-

Reference Readings:- 1 Solid State Electronic Devices: Streetman & Banerjee;Pearson
2 Electronic Devices And Circuits: Milliman's & Halkins; MGH
3 Electronic Devices And Ckt Theory: Boylested & Nashelsky; Pearson

Doc. No.: DCE/0/15
Revision :00

Lecture Plan-37

Semester:-**IIIrd** Class:-**ECS** Course Code:**EC-312-F**

Subject:-**Electrical Engineering Materials And Semiconductor Devices** Unit:-**1II**

S. No.	Topic :- FERROMAGNETISM AND FERROMAGNETIC DOMAINS	Time Allotted:-
1.	**Introduction** Ferromagnetism is characterized by the presence of parallel alignment of permanent magnetic dipole moments in a single direction. Among the elements, ferromagnetism occurs in the iron ,cobalt,nickel.the important common characteristics of these elements is the existence of partly filled inner electron shell. In a ferromagnetic material, magnetization arises spontaneously over the large region of the material.	10 min
2	**Division of the Topic** ➢ Ferromagnetism ➢ Curie Weiss law ➢ Curie constant ➢ Coercive constant ➢ Spontaneous magnetization and Weiss theory of ferromagnetism ➢ Ferromagnetic domains ➢ Different types of hysteresis loops	30 min
3.	**Conclusion** Ferromagnetism is caused by the spin of electrons. Each electron behaves like a minute magnet which points its north pole up or down the magnetic field H according to the direction of the spin. In ferromagnetic atoms, more electrons spin one way than the other and the atoms behave like a magnet.	5 min
4	**Question /Answer** **Q. Who proposed the theory of magnetic domains?** **Ans.**weiss **Q. What type of material should be used for the transformer?** **Ans** low hysteresis loss.	5 min

Assignment to be given:-

Reference Readings:- 1 Solid State Electronic Devices: Streetman & Banerjee;Pearson
2 Electronic Devices And Circuits: Milliman's & Halkins; MGH
3 Electronic Devices And Ckt Theory: Boylested & Nashelsky; Pearson

Doc. No.: DCE/0/15
Revision :00

Lecture Plan -38

Semester:-**IIIrd** Class:-ECS Course Code:**EC-312-F**

Subject:-**Electrical Engineering Materials And Semiconductor Devices** Unit:-**1II**

S. No.	Topic :- MAGNETOSTRICTION, EDDY CURRENT LOSS ,APPLICATIONS OF FERRITES.	Time Allotted:-
1.	**Introduction** When a ferromagnetic material is magnetized, changes in physical dimensions in general occur. This phenomenon is known as the magnetostriction.three types of magnetostriction is generally referred to : Longitudinal magnetostriction, transverse magnetostriction and volume magnetostriction	10 min
2	**Division of the Topic** ➢ Introduction to magnetostriction ➢ Types of magnetostriction: Longitudinal o Transverse o volume ➢ Ferrimagnetisms ➢ Application of ferrites	30 min
3.	**Conclusion** Ferrites have very high resistivity A microwave dielectric constant of the order of 10-12 Extremely low dielectric constant A saturation magnetization which is appreciable , but noticeably smaller than that of ferromagnetic materials and low coercive force	5 min
4	**Question /Answer** **Q.What is the resistivity of ferromagnetic materials?** **Ans.**more than 10^5 ohm-cm **Q. What is the nature of ferrites?** **Ans** hard, brittle and these are difficult to machine.	5 min

Assignment to be given:-

Reference Readings:- 1 Solid State Electronic Devices: Streetman & Banerjee;Pearson
2 Electronic Devices And Circuits: Milliman's & Halkins; MGH
3 Electronic Devices And Ckt Theory: Boylested & Nashelsky; Pearson