Q.2 What are soft and hard ferrites and where they are used? b. Why Iron Silicon alloys are preferred for power transformers, motors and generators? c. Give the applications of following material (i) Alnico (ii) Hard Ferrites Answer: PNJ (a) Soft magnetic material have a steepfy sising magnetisations curve. These material have high permarbilities. The are used as cose malerial in magnetic exts of electromagnetic equipment eg soft inon, silicon, steel ele Hand magnetic material are characterized by a high maximum megnetic energy product (B-H) max. These materials have gradually rising magnetisation cuevic. These materials are comployed as permanent magnets. Callon steel, tungsten steel, cobalt steel etc because Silicon Iron increases the electrical 6 resistivity of 1200, 97 increases permashility at low and moderate flux dentilies but decreases at higher ym densilies. Addition of silicon reduces hysteresis loss. The magnetostriction effect is also reduced (c) Abrico find applications in loudspeaker, microware dences, motors, generators, méleis, magnetos sparators, communication devices and vending mechines Hard finite. The magnets are made in the form of mings, blocks and area. These are used in applications for land speckers, de motors, microwave over, magnetion tubes, travelling wave tubes, holding mapual etc.

a. Explain, what causes the decrease in resistivity of an intrinsic Q.3 semiconductor at high temperature? b. What is Hall effect? What are the applications of Hall effect generator? c. What are important properties of semiconductor? d. Compare in brief the materials used in IC packaging. Answer: At room temps. covalent bonding is very strong (9) and no free electronis available there for semicorducty in pure state behave as an monleter but as temp. maesies their resisting decrease due to hagaine temp coefficient (b) when a current ceering conductor is placed. In in a magnetic field, a voltage is produced which acts is perpendicular direction to the current as well as to the magnetic hield. it Hall affect couge and generator to massure (1) magnatic field shrights ward in fless meters (2) (The and runs is used in analogous composters (4) Indium anti monide is used to make compareses with high degree of sensitivity (C) (1) The resistinty of semiconductor lies in between conductor and menleter. Le. 0.6 nm Resistance of conductors increases with the minease of (0) 1 temprature. but semi condudor résistance de creases usis lenplatine. (17:) when a controlled quartity of a foreing material is added to a semiconductor its properties are putter changed and it shows good adriductivity (d) Dip package is preferred because it is very to mount as mounting does not sepured bending of leads Caramic DIP is prepared where power dissipation is more in comparación to plastic package metal com package in compassacion if preferred in power dusipation is much nigher flat pack is used in applications where methability and how weight are considerations

Q.4 a. What are different types of diode? Discuss each briefly.b. What are different methods of manufacturing transistor? Explain Alloy

type method in detail.

Answer: Different type of Diodes are (1) Tunnel diode (1) Zener Dode (1) Schottley diode (N) Varactor diode (V) Photo diode (V) LEDS (0) Power Diode (Vii) (i) Tunnel Diode: This duide is fabricated by doping the semiconductor materies that will ferm the p-n function at a level one hundred to several thousand times that of a typical semiconductor divide , which raduce depletion larger and due to depletion, many Carriers can "tunnel" through (ii) Zener Diode for these divide doping derisity is Very high. Zener breakdown occurs at a nevera sias potentiel of VZ. The Zener voltage of a diode can be controlled by changing doping levels, producing an increase in humber of added impunilies, will dedesse 10

Schottby Diodo: These doode have metal semiconductors
function. The semiconductor is usually in type Silicon, while
have a different metal such as molybdenum politinum
et are used. Different construction techniques vasults increased browning range, cover formind bias etc / m
increased browney range, cover forming star ele 1th
Variator Diode! A simple clude under revere sins
conditions constitutes varacter dude and acts as a
valtage variable capacitor. The dependent internet
of deplection layers varies with applied vollage 17
I COL: at is a PH jenction when forward biased,
emite light due to change conier recordination
LEDS: It is a PH jenctions when tomad braised, emite light due to change conten recordination occurs at the fination, change channel gives up -/ energy in The form of light. and heat. The indexal used for manufacture of LED's gallium assende, phusphide etc.
energy in the form of them allow accorde
used for manufacture of the of
phosphide etc. Pdroto Diode: St. Co a reverse biased junction dude uslo eight permitted to fall on one surface of the device while minimized. The pri junction is lembedded in fr clease plastic package power Diode: These dude are doughed to handle high
cafer hermitted to fall on one surface of the device
econs the function, keeping the remaining sider
undelleminated. The pro functions is with course of
clear plastic party
Tower Drove high temperature demands of some
cleare plastic package <u>Power Diode</u> : These dude and doigned to hardle high power and high temperature demands q some applications. Most q power dude are constructed using solicion because q higher current, temperature and piv varing.
using solicon because of higher current, tempsource
and PIV values methods aren)
b. manufactive Transfor methods are b. manufactive Transfor methods are (in) Diffusiontype (2
()) Grown with a line of a
(1) Epitoderical type
Alloylipe: This technique is also called the fused
concervation i le d'indium
of a type material two prode acts wrafter and the attached to appointe sides of the wrafter and the a short time to a short time to a short time to a short temperature, alone we meeting point of Indium
attached to raised for a short time to a
when temperature, alove we meeting point of indian .
but below that of germanium. The indus
dissolves the germanium under it and formsa
saturation solution - On cooling The gaimanium.
in contact with the base material recuystallizes
with enough idium concentration to charge it from
In type to p type. The collocker is made larger than -
the lemittee so that the collector subtends a large
angle as viewed from the emitter Because of this
gdo metrical assanguents, very little emitter current
bollows a deflusion both which carries it to the
base sather than to the collocter.

- **Q.5** a. Describe the construction detail of relays and List common type of relays.
 - b. An air capacitor of capacitance $0.005 \ \mu\text{F}$ is connected to direct voltage of 500V, is disconnected and then immersed to oil with a relative permittivity of 2.5. Find the energy stored in the capacitor before and after immersion.

Answer: Ralary consists of three basic clorents 15 (a) (1, an actualing element collect exciting Loig linkage to transfer the actuation/de-actuation Gil of infault to ant put (iii) Output elements or the contacts formaline Amstruce 1722 - reminals HINGE 80. Busticons conlact insulation ter mine Retren spring Coil terminal Fig shows constantion of general purpose dechomagnet relay - It contains core sussanding by coil of wines The case is monted on moter provine. The movable part of relay is called armetine when a voltage is applied to The coil, current flowing through it produce a magnetic bield in the case. In other words the case alters classonagnetic and atleast the motel armetime. - france when the armetine is attract to the case, the magnetic path is from the case through armative through the frame and back to the core on romeving the voltage, the spring attached to The corrective returns the armative to the original positions . In this position there is small gap. Hence more power is needed to keep it's hold in the attracted positions Common type q Polays (1) Latching Relay (i) Rotary stepping selay (1) Rotchet Rolay (iv) Polarized relay (v) so keroid 200 relay vi) Solid State Relay (viii) Ponce Polay Energy before immersion's (6) E1= ± cN2 = ± × 0.005×106×(500) Jamal = 625×106J When immersied in oil, its capacitance is increased 2-5 times. Since charge is contant, voltage must becomes 2.5 + mies. "tence new capacilance becomes 2.5 × 0.005 = 0.0125 4F and new nothings 500 = 200 V E2 = 1 × 0.0125× 106×(200)2 (3 mach = 250 ×156 J

a. Explain the following processes of fabrication technology. **Q.6** (ii) Metallization (i) Oxidation Answer: (pri 6 (a) oxidation: the An oxide layer is grown as the silecon surface. The chaeselastics (HF) to which undergoing siliton is impervious (5) The imposities used to dope the siliion do not penetrate the silicon didide. So when used with the masking techniques selective doping of specific region of this is accomplished Thormal oxidation is achieved in the presence of water vapours - The chemical reaction is Sit 2420 - \$ 5102+242 The thickness of the oxide layar is generally of the order of 0.02-1. 2 him. the specific value solected depends on the bassin required to present dopant peretation Impiniby concentration, processing this processing time and process temp are some of the factors that decide the -thickness of the S.O2 layer. The SizNy (Silicon nitride) is used as a sandwich between two So, Layor Metallization: This process is used to form the inter connections of the components on the Chip. These are bormed by the deposition of a thin layer of aluminium over the entire surface of the chip. Deposition is achieved by high vacuum evaporation wide a bell jar. The aluminium is heated untill it is reprings the gaseous malecules formed uniformly radiate in all directions & completely cover the water surface. A mask is used to define the connection pattan between the components and the unwanted alyminium is etched & removed there finilip

b. Describe 'Grown Junction' method of Fabrication in brief. Answer: Page Number 392 OF Text Book

- **Q.7** a. Explain, how permittivity of a dielectric material is analogous to permeability of magnetic material?
 - b. State the factors which affects the dielectric loss of an insulating material.
 - c. Explain Dielectric breakdown in gasses.

Answer:

material for developing across the when a weltage is applied across the amount of solenoid it will set up a certain amount of solenoid it Juile set up a certain amount of flux due to amount bollowing through the solenoid. If a piece of megnetic material is introduced inside the solenoid, the amount of flux celup incleases so inductance incleares as the permeability of the path. for magnetic Law increases hu of the path for magnetic flux increases by copication - the value of the capacitance increases as the bermitivity of the path for electric flux increases the permandely of magnetic material is different too different magnetic materials litewice permittivity is also different for different dielectricas (b) with loss increases proportionately with the frequency of opplied voltage (i) Presence of humidily increases. The loss (ii) Temperature rise hosmoley increase the loss (iii) Voltage increase causes increased direction (c) All the gases are normally good indulators, and their betaviour is more collect same ustren and their betaviou is more collect same ustern subgitted to an electric field. If a Dc vollage is applied to a gas placed betweens two conducting surfaces. The electron present in the gas more to the anede and an equal number of the ione more toward cathod. At a recoult a current flow which follows office laws (OA) show in 63. At a cectain voltage of an electric value of the voltage become almost constant (AB). If the voltage the current flow of a cectain value of the voltage the current the breakdown of the gas decine, the reached when the breakdown of the gas decine, the gas looses its, dielectric properties and turns and turns and conducter. The value of this voltage to called the conducter. The value of this voltage to called the conducter of the value of the set of the called the conducter of the value of the gas decine, the of the conducter of the value of the called the conducter of the value of the set of the called the conducter of the value of the set of the called the conducter of the value of the set of the called the conducter of the value of the set of the called the conducter of the value of the set of the called the conducter of the value of the set of the set of the set of the called the conducter of the value of the set of t martin B A 1.0 > V induial gave

0.8 a. What is Mobility? Describe in brief. Answer: Page Number 93 of Text Book

b. The resistance of a wire is 60 Ω or 25°C and 65 Ω at 75°C. Find the resistance of wire at 10°C and value of temperature coefficients at 0°C

Answer:

(b)
$$R_{15} = 60 n$$
 $R_{75} = 65 n$
 $R_{+} = R_0 (1 + x_0 t)$ $R_{15} = R_0 (1 + x_0 + 5) (1)$
 $R_{15} = R_0 (1 + x_0 + 5) (1)$
Dividing (1) by 2
 $\frac{R_{25}}{R_{75}} = \frac{R_0 (1 + 25x_0)}{R_0 (1 + 75x_0)} = \frac{60}{65} + \frac{1 + 25x_0}{1 + 75x_0}$
 $60 + 4500 d_0 = \frac{65 + 1625 x_0}{R_0 (1 + 75x_0)} = \frac{60}{1 + 75x_0} = \frac{60}{1 + 0.001739}$
 $R_{2875x_0} = 5$ $x_0 = 0.001739$ A_{11x_3}
 $R_{25} = R_0 (1 + x_0 t)$ $R_{02} = \frac{R_{15}}{1 + x_0 t} = \frac{60}{1 + 0.001739} = \frac{60}{1 + 0.001739}$
 $= 53.7n$ Ans.

Q.9 Explain polarization mechanism and give the comparison of electronic, ionic and dipole polarization.

Answer: Page Number 142-143 of Text Book

TEXT BOOK

Introduction to Electrical Engineering Materials by C.S. Indulkar and S. Thiruvengadam, 4th Edition, Reprint 2006 Edition, S. Chand and Company, New Delhi.