Past Paper 2022

Short Questions

1. Calculate the voltage across 2 ohm register where supply voltage is 10?

To calculate the voltage across a 2 ohm resistor when the supply voltage is 10 volts, we can use Ohm's Law, which states that V = IR, where V is the voltage, I is the current, and R is the resistance.

In this case, we know the resistance R is 2 ohms and the supply voltage V is 10 volts. To find the current I, we can use the equation I = V/R.

So, I = 10/2 = 5 amps.

Now that we know the current flowing through the resistor is 5 amps, we can use Ohm's Law again to find the voltage across the resistor:

V = IR = 5 * 2 = 10 volts.

Therefore, the voltage across the 2 ohm resistor is 10 volts.

2. What kind of energy is stored in capacitor ?

Capacitors store electrical energy in an electric field between two conductive plates.

3. What is the most common type of resistor?

The most common type of resistor is the carbon film resistor. This type of resistor is made by depositing a thin layer of carbon onto a ceramic substrate and then spiraling a metal wire around the carbon film to create the resistive element.

4. What is eddy current?

Eddy currents are loops of electrical current that are induced within conductive materials when they are exposed to a changing magnetic field.

5. Define the net charge on N type material.

Scanned with CamScanner

The net charge on N-type material is zero, as the negatively charged electrons introduced by the doping are balanced by an equal number of positively charged protons in the atomic nuclei of the material.

6. Is it meaningful to say atom is ferromagnetic?

It is not meaningful to say that an individual atom is ferromagnetic because ferromagnetism is a property that arises from the collective behavior of many atoms within a material, rather than from the properties of individual atoms.

7. Write down factors upon which self-inductance of coil depend.

The self-inductance of a coil depends on the number of turns, geometry, material, cross-sectional area, presence of a magnetic core, and frequency of the current.

8. Briefly explain photodiode?

A photodiode is a type of semiconductor device that converts light into an electrical current. It is a type of diode that is designed to be sensitive to light, and it operates by absorbing photons and generating an electron-hole pair in the semiconductor material.

9. What is full wave rectification?

Full-wave rectification rectifies the negative component of the input voltage to a positive voltage, then converts it into DC (pulse current) utilizing a diode bridge configuration.

10. What is reverse saturation current?

Under reverse bias conditions, there is practically no current due to majority carriers,yet there is a small amount of current due to flow of minority carriers across the junction The battery drives these minority carriers across the junction thereby producing a small current called reverse current or reverse saturation current.

11. Differentiate between regulated and unregulated power supply.

Scanned with CamScanner

The main difference between regulated and unregulated power supplies lies in their ability to provide a consistent output voltage.

An unregulated power supply is a type of power supply that provides a fixed DC voltage output, but the output voltage is not regulated or controlled. This means that the output voltage may vary depending on factors such as the load, input voltage, and temperature.

On the other hand, a regulated power supply is designed to provide a stable and consistent output voltage, regardless of changes in the load, input voltage, or temperature.

12. Define Zener diode.

A Zener diode is a type of diode that is designed to operate in the reverse breakdown region of its voltage-current characteristic curve. It is essentially a heavily doped p-n junction diode that is designed to conduct current in the reverse direction when a certain voltage threshold is reached, which is known as the Zener voltage or breakdown voltage.

Long Questions.

....Question no 2....

a) Numerical part of long question see question in paper..

α=?	**β=49**	**$I_{B=}$240**
I_c=?	**I_E=12mA**	

Solution:

$\alpha=\beta/1+\beta$

$\alpha=49/50$

$\boxed{\alpha=0.98}$

$I_c=\beta\ I_B$

Scanned with CamScanner

$I_c=49(240 \times 10^{-9})$

$\boxed{I_c=0.01176=7.6 \times 10^{-4}A}$

$I_c=\alpha/1-\alpha(I_B)$

$I_c=0.98/1-0.98(240 \times 10^{-9})$

$I_c=49(240 \times 10^{-9})$

$\boxed{I_c=0.01176=7.6 \times 10^{-4}A}$

b) What is transformer and how does it work with diagram?

Transformer:

Transformers are electrical devices consisting of two or more coils of wire used to transfer electrical energy by means of a changing magnetic field. In brief, a transformer is a device that..

Transfers electric power from one circuit to another

Does so without changing the frequency

It does this using electromagnetic induction and

When the two electric circuits are mutually inductively influenced

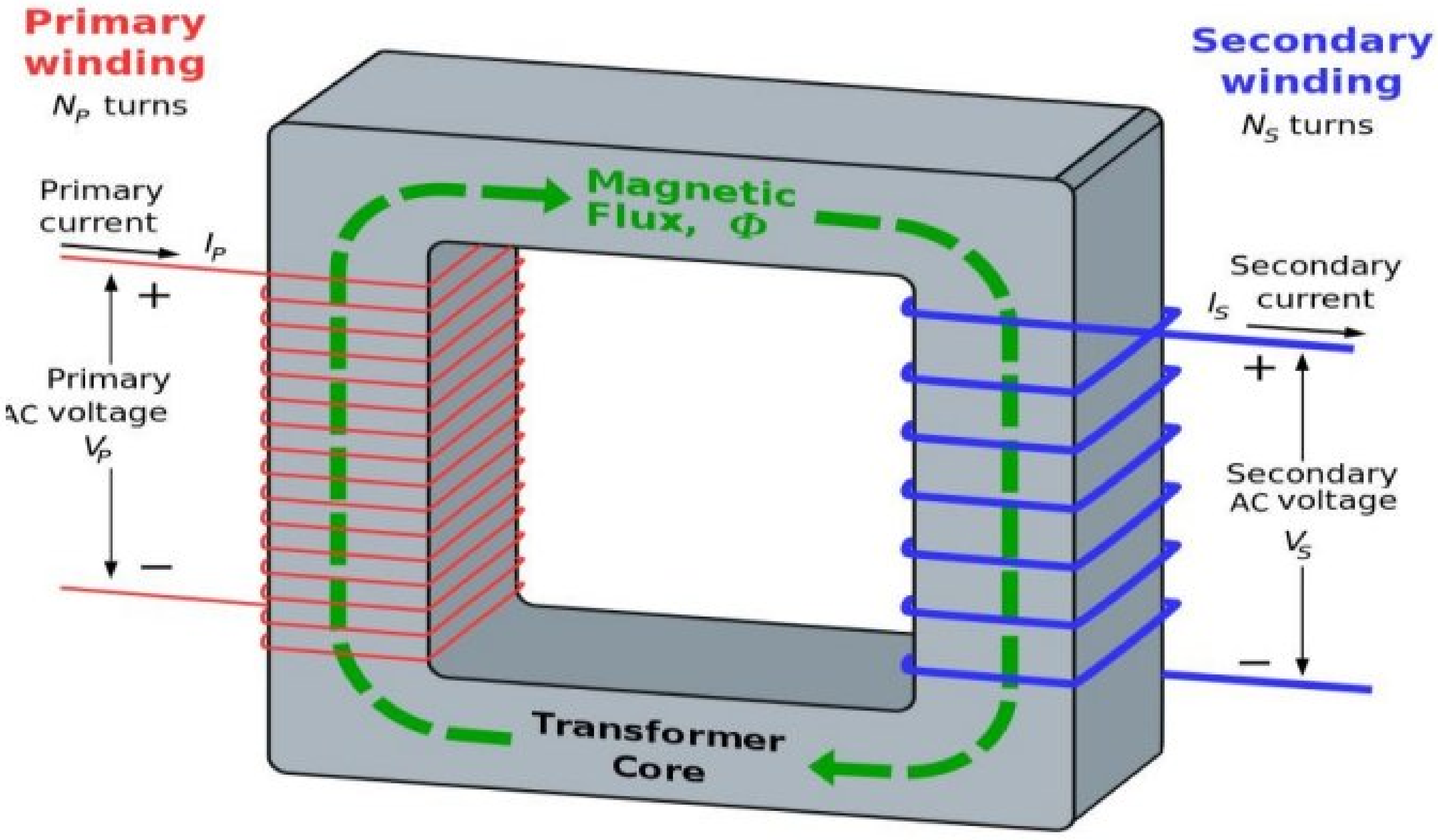
Working principle of transformer:

The working principle of transformer is based on Faraday's Law of Mutual Induction or Electromagnetic Induction, which happens between two circuits connected by a mutual magnetic flux.

When current flows through an electric wire coil, it generates a magnetic field or magnetic flux across its whole surface. For every material, the magnetic flux or magnetic field is defined as the "temporary medium" through which magnetized forces are transmitted between electric materials. Let's mention that we frequently experience these forces inadvertently in our daily lives, such as when some ferromagnetic elements (iron, cobalt, or nickel) behave as temporary magnets in the presence of permanent magnets, attracting or repelling other magnets or electric materials.

Scanned with CamScanner

The strength of the magnetic, on the other hand, is directly proportional or let's say very reliant to the flow of current in the wire. As a result, the intensity of a magnetic created by an electric current may be readily managed, reversed, turned on or off, or varied. The magnetic field may be thought of as outlines of magnetic flux that form closed pathways. You can see a schematic of a magnetic field (flux lines) produced around a wire carrying an electric current in the picture below.



....Question no 3....

a) What are different methods of biasing? Discuss voltage divider bias.

In the context of electronic devices, biasing is the process of setting a device's operating point, or bias point, in order to achieve optimal performance. There are several methods of biasing, including:

Fixed Bias: This is the simplest method of biasing and involves connecting a voltage source, such as a battery, to the base of the transistor through a resistor.

Collector Feedback Bias: This method uses a resistor between the collector and base of a transistor to provide feedback and stabilize the operating point.

Emitter Bias: In this method, the emitter of a transistor is directly connected to a voltage source, providing a constant bias voltage.

Voltage Divider Bias: This method uses two resistors in a voltage divider configuration to bias a transistor.

Self-Bias: This method involves connecting a resistor between the base and collector of a transistor to provide a self-bias voltage

Scanned with CamScanner

Current Mirror Bias: This method uses a current mirror circuit to bias a transistor by mirroring the current in a reference transistor.

These methods are not exhaustive, and there are other techniques that can be used for different applications and devices.

Voltage Divider Bias:

Voltage divider bias is a method of biasing a transistor in which two resistors are used to create a voltage divider network that provides the base bias voltage for the transistor. This method is widely used due to its simplicity and relatively stable operating point.

The voltage divider bias circuit consists of a voltage source, two resistors (R1 and R2), and a transistor.

When the transistor is biased using the voltage divider bias circuit, it operates in the active region, where the collector current is proportional to the base current. The voltage divider bias circuit provides a stable operating point, as the base bias voltage is relatively insensitive to variations in the transistor's characteristics, temperature, and power supply voltage.

One disadvantage of the voltage divider bias circuit is that it requires a relatively high supply voltage to ensure that the base bias voltage is adequate. Also, the bias current is not very well controlled and can vary with temperature and transistor parameters, leading to a less stable operating point compared to other biasing methods.

b)Explain different types of capacitor.

Capacitors are electronic components that store electrical charge and energy, and they are used in a wide range of electronic circuits. There are several types of capacitors available, each with their own unique characteristics and applications. Here are some of the most common types of capacitors:

Ceramic capacitors:

Ceramic capacitors are small, inexpensive, and widely used in electronic circuits. They are made of ceramic material and have a high dielectric constant, which allows them to store a large amount of charge in a small space. They are available in a wide range of capacitance values and voltage ratings, and they are often used in high-frequency applications due to their low inductance.

Electrolytic capacitors:

Scanned with CamScanner

Electrolytic capacitors are polarized capacitors that use an electrolyte as the dielectric. They are available in two types: aluminum electrolytic and tantalum electrolytic capacitors. They are capable of storing a large amount of charge and are often used in applications that require high capacitance values and low ESR (Equivalent Series Resistance).

Film capacitors:

Film capacitors are made of plastic or polyester films and have a high tolerance for voltage and temperature changes. They are available in a wide range of capacitance values and are often used in applications that require stability, accuracy, and low loss.

Supercapacitors:

Supercapacitors, also known as ultracapacitors or electric double-layer capacitors (EDLC), are capacitors that can store a very large amount of charge and energy. They are used in applications that require high power density, high energy density, and fast charge and discharge cycles, such as in electric vehicles and renewable energy systems.

These are just a few of the many types of capacitors available, and each type has its own advantages and disadvantages depending on the application. The choice of capacitor type depends on the specific requirements of the circuit or system, including capacitance value, voltage rating, temperature range, size, and cost.

….Question no 4….

Discuss base band theory in detail. Also explain diamagnetism Parramagnetism ferromagnetism.

Base band theory:

The base band theory of solids is a branch of solid-state physics that explains the electronic properties of materials such as metals, semiconductors, and insulators. The theory is based on the principles of quantum mechanics and provides a framework for understanding the behavior of electrons in solids.

According to the base band theory, the energy levels of electrons in a solid are quantized into energy bands. The lowest energy band is called the valence band,

Scanned with CamScanner

and the next higher energy band is called the conduction band. The energy gap between these two bands is called the band gap.

In conductors, the valence and conduction bands overlap, allowing electrons to move freely through the material, and thus conduct electricity. In insulators, the band gap is large, and electrons are tightly bound to their atoms, making it difficult for them to move and conduct electricity. Semiconductors have a small band gap, which allows some electrons to move to the conduction band, making them partially conductive.

The base band theory is important for understanding the behavior of electronic devices such as diodes, transistors, and integrated circuits, which are based on the properties of semiconductors. The theory is also used in the design and analysis of electronic materials and devices.

In summary, the base band theory of solids is a fundamental concept in the field of solid-state physics, and it provides a foundation for understanding the behavior of electrons in solids, which is essential for the development of modern electronic devices.

Diamagnetism:

Diamagnetism is a type of magnetism that is exhibited by certain materials in the presence of an external magnetic field. Diamagnetic materials have a weak, negative magnetic susceptibility, which means that they will be repelled by an external magnetic field. Unlike ferromagnetic and paramagnetic materials, which are attracted to a magnetic field, diamagnetic materials are repelled by it. Diamagnetic materials do not have unpaired electrons, which means that they do not have a net magnetic moment. When a diamagnetic material is placed in an external magnetic field, the magnetic field induces small currents in the material, which creates an opposing magnetic field that causes the material to be repelled by the external field. Diamagnetism is a fundamental property of all materials, but it is usually very weak, and its effects are often masked by other forms of magnetism. However, some materials, such as bismuth, copper, silver, and gold, are strongly diamagnetic and exhibit noticeable repulsion in the presence of an external magnetic field.

Parramagnetism:

Paramagnetism is a type of magnetism exhibited by certain materials that are attracted to an external magnetic field. Paramagnetic materials have a positive

Scanned with CamScanner

magnetic susceptibility, which means that they are weakly attracted to an external magnetic field.
In paramagnetic materials, some of the electrons are not paired, which means they have a net magnetic moment. When a paramagnetic material is placed in an external magnetic field, the magnetic field aligns the magnetic moments of the unpaired electrons, which causes the material to be weakly attracted to the external field.

Paramagnetism is important in many areas of science and technology, including materials science, magnetism, and magnetic resonance imaging (MRI). In MRI, paramagnetic materials, such as gadolinium chelates, are used as contrast agents to enhance the visibility of certain tissues or structures.

Ferromagnetism:

Ferromagnetism is a type of magnetism exhibited by certain materials that are strongly attracted to an external magnetic field. Ferromagnetic materials have a high positive magnetic susceptibility, which means that they are strongly attracted to an external magnetic field. In ferromagnetic materials, the magnetic moments of the electrons are aligned in a parallel manner, which results in the creation of magnetic domains.

Ferromagnetic materials include iron, nickel, cobalt, and some rare earth metals. They exhibit permanent magnetization even in the absence of an external magnetic field. This property makes ferromagnetic materials useful in the production of magnets and other magnetic devices.

….Question no 5….

a) Numerical part of long question see question in paper..

Solution:

R1 || R2 || R3

1/Rab=1/12+1/12+1/12

=1+1+1/12

=3/12

=1/4

R4 || R5

1/Rbc=1/12+1/12

=1+1/12

= 2/12

=1/6

Rbc=6ohm

1/Rcd= 1/R6+1/R7+1/R8+1/R9

=1/12+1/12+1/12+1/12

=1+1+1+1/12

=4/12

=1/3

Rcd=3ohm

Rcde= Rcd+Re

= 3+12

= 15ohm

Req= Rab+Rbc+Rcde

=4+6+15

= 25ohm

b)Write a note on Ohm law of magnetism.

Magnetic circuit having iron path only.There is a small air gap in the circuit. Like electric circuit,a magnetic circuit also has three quantities interconnected by a law similar to Ohm's law.

There is three quantities are:

1.Magnetomotive force (MMF)

2.Magnetic Flux

3.Reluectance (S)

- **Magnetomotive force (MMF):**

It resembles voltage ot electromotive force (EMF) in an electric circuit and is responsible for producing magnetic flux in a magnetic circuit.Its value is given by the product of current through the coil and its number of turns i.e.,NI. Its unit is ampere-turn*.

Scanned with CamScanner

- **Magnetic Flux**

It resembles current in an electric circuit. It consist of magnetic lines of force and its unit is weber.

- **Reluectance (S)**

It resembles resistance in an electric circuit. Its represents the opposition which a core offers to the production of flux through it. Its value is

$$S=l/\mu A=l/\mu o \mu r$$

Its unit is reciprocal henry.

Ohm law for magnetism circuit is:

$$Flux=mmf/reluctance=Nl/s \text{ weber}$$

$$Nl/l/\mu A = \mu NAl/l = \mu o \mu rNAl/l \text{ weber}$$

….Question no 6….

What is difference between intrinsic and extrinsic semiconductor materials? Explain the role of doping of an impurity in a semiconductor material.

INTRINSIC SEMICONDUCTORS (PURE SEMICONDUCTOR):

An intrinsic semiconductor is one which is made of the semiconductor material in its extremely pure form.

Common example of such semiconductor are:pure germanium and silicon.

The energy gap is so small that even at ordinary room temperature. There are many electrons which passes sufficient energy to jump across the small energy gap from the valence to the conduction band.

When an electric field is applied to an intrinsic semiconductor at a temperature greater than 0°K,conduction electrons move to the anode and the holes move to the cathode.

XTRINSIC SEMICONDUCTORS (IMPURE SEMICONDUCTOR):

These intrinsic semiconductor to which some suitable impurity or dropping agent has been added in extremely small amount (about 1 part in 10 to power 8) are called extrinsic or impurity semiconductors.

Scanned with CamScanner

Usually the doping agents are pentavalent atoms having five valence electrons. Pentavalent doping atoms is known as donor atom because it donates one electron to the conduction band. The trivalent atoms,on the other hand, is called acceptor atom because is accepts one electron from the germanium atom.

Depending on the type of doping material used, extrinsic semiconductor can be further subdivided into two classes;

(1) N-type semiconductor

(2)P-Type semiconductor

(1)N-TYPE EXTRINSIC SEMICONDUCTORS:

This type of semiconductor is obtained when a pentavalent material like antimony (Sb) is added to pure germanium crystal. Each antimony atom forms covalent bonds with the surrounding four germanium atoms atoms with the help of four of its five electrons. The fifth electron is superfluous and loosely bound to the antimony atom. It can b easily excited from the valence band to the conduction band by the application of electric field. Antimony is called donor impurity and makes the pure germanium an N-type extrinsic semiconductor.

2) P-TYPE SEMICONDUCTORS:

This type of semiconductor is obtained when traces of a trivalent impurity like boron (B) are added to a pure germanium crystal.

In this case, the three valence elections of boron atom from covalent bonds with four surrounding germanium atoms,but one bond is left incomplete and give rise to a hole. Thus, boron which is called an acceptor impurity, causes as many positive holes in a germanium crystal as there are boron atoms thereby producing a p-type extrinsic semiconductor.

Role of doping of an impurity in a semiconductor material:

Impurities are added into a semiconductor to actually increase the electric conductivity. The process of adding an impurity into the semiconductor to increase its ability to conduct electricity is known as doping and the impure semiconductor is known as a doped semiconductor.

Scanned with CamScanner

University of Sargodha

BS 1st Term Examination 2022

Subject: CS/IT **Paper: Applied Physics/ Basic Electronics (PHYS-101/PHY-2210)**

Time Allowed: 02:30 Hours **Maximum Marks: 60**

Note: Objective part is compulsory. Attempt any three questions from subjective part.

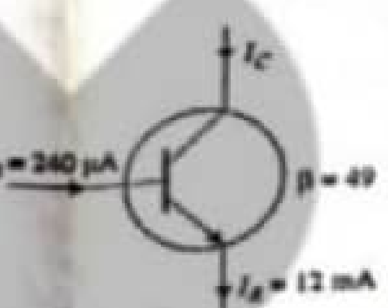
Objective Part (Compulsory)

Q.1. Write short answers of the following in 2-3 lines each on your answer sheet. (2*12)

i. Calculate the voltage across 2-ohm resistor where supply voltage is 10 V.
ii. What kind of energy is stored in a capacitor?
iii. What is eddy current?
iv. What is the most common type of the resistor?
v. Define the net charge on the N-type material.
vi. Is it meaningful to say that atom is ferromagnetic?
vii. Write down the factors upon which self-inductance of the coil depends.
viii. Briefly explain the Photodiode.
ix. What is full wave rectification.
x. What is reverse saturation current?
xi. Differentiate the regulated and unregulated power supplies.
xii. Define Zener diode.

Subjective Part (3*12)

Q.2. (a) Find the α rating of the transistor shown in Figure. Hence determine the value of I_c using both α and β rating of the transistor. (6)



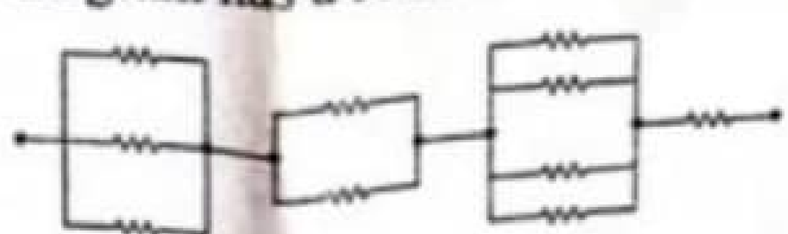
(b) What is transformer and how does it work? Write conditions for ideal transformer (6)

Q.3. (a) What are different methods of biasing? Discuss volage divider bias. (6)

(b) Discuss the different types of capacitors. (6)

Q.4. Discuss band theory in detail. Also explain diamagnetism, paramagnetism and ferromagnetism. (12)

Q.5. (a) Each of the resistors in the diagram has a resistance of 12 Ω. Find the total resistance. (6)



(b) Discuss Ohm's law of magnetism. (6)

Q.6. What is the difference between intrinsic and extrinsic semi-conductor materials? Explain the role of doping of an impurity in a semi-conductor material. (12)

SHAHAB

Scanned with CamScanner