Assignment

Paper 2021

Short Questions:-

i. Give the advantages of PIN photodiodes.

PIN photodiode advantages:-

. It has high light sensitivity.
. The response speed is high.
. Its bandwidth is wide.
. Implementation cost is low.
. It generates low noises.
. It is small in size.
. Temperature sensitivity is low.
. Longevity better than standard diodes.

ii. How the op-amp comparator should be chosen to get higher speed of operation?

Scanned with CamScanner

Scanned with CamScanner

The bandwidth of the op-amp comparator must be wider so that the output of comparator can switch rapidly between saturation levels.

iii. Define the different operating regions of transistor?

There are three regions are the i. emitter region (E) ii. base region (B), iii. collector Region (C). and these regions are differently doped depending on the type of bipolar transistor it is,

iv. What is meant by drift current?

Drift current arises from the movement of carriers in response to an applied electric field. Positive carriers (holes) move in the same

Scanned with CamScanner

Scanned with CamScanner

direction as the electric field while negative carriers (electoons) move in the opposite direction.

v. Define magnetic reluctance?

Magnetic reluctance, or magnetic resistance, is a concept used in the analysis of magnetic circuits. It is defined as the ratio of magnetomotive force (mmf) to magnetic flux. It represents the opposition to magnetic flux, and depends on the geometry and composition of an object.

vi. What are transducers?

A transducer is an electronic device that converts energy from one form from the another. Common examples include microphones, loudspeakers,

Scanned with CamScanner

Scanned with CamScanner

thelmometels, position and pressure sensors, and antenna.

vii. What is difference between zenel breakdown and ad avalanche break down.

The most significant difference between the two is that the zenel breakdown occurs due to the strong electoic field caused by the high doping(nattow depletion region). Avalanthe breakdown occurs due to thermal collision caused by the increased reverse bias voltage.

viii. In an NPN silicon transisto , $\alpha = 0.995$, $I_E = 10mA$ and leakage current $I_{CBO} = 0.5\mu A$. Determine I_{CEO}.

$$I_{CBO} = 0.5\mu A$$

$$I_E = 10mA = 10 \times 10^{-3} A$$

Scanned with CamScanner

Scanned with CamScanner

$I_{CEO} = ?$

$I_C = \alpha I_E = 0.995 \times 10 \times 10^{-3}$

$I_C = 995 \times 10^{-3} A$

$I_C = \alpha I_E + I_{CEO}$

$995 \times 10^{-3} = 0.995 \times 10 \times 10^{-3} + I_{CEO}$

$995 \times 10^{-3} = 995 \times 10^{-3} + I_{CEO}$

$995 \times 10^{-3} - 995 \times 10^{-3} = I_{CEO}$

$0 = I_{CEO}$

ii. In a BJT, the collector current is, 12mA and the emitter current is 1.02 times the collector current. Find the base current.

$I_C = 12mA = 12 \times 10^{-3} A$

$I_E = 1.02 = 1.02A$

$I_B = ?$

$I_E = I_B + I_C$

Scanned with CamScanner

Scanned with CamScanner

$$I_B = I_E - I_C$$

$$I_B = 1.02 - 12 \times 10^{-3}$$

$$I_B = 1.008\ A$$

x. A silicon diode passes a current of 100mA at 1V. Find the bulk resistance

$$I = 100mA = 100 \times 10^{-3} A = 0.1A$$

$$V = 1V - 0.7V = 0.3V$$

$$R = \frac{V}{I} = \frac{0.3}{0.1} = \boxed{3\ \Omega}$$

xi. For the common-emitter transistor $\beta = 100$ and $I_B = 50\mu A$. Compute the value of I_C and I_E.

$$I_B = 50\ \mu A$$

$$\beta = 100$$

$I_C = ?$

$I_E = ?$

Scanned with CamScanner

Scanned with CamScanner

$$I_C = \beta I_B$$

$$I_C = 100\,(50\times10^{-6})$$

$$\boxed{I_C = 6.4\times10^{-9}}$$

$$I_B + I_E = I_C$$

$$I_E = I_B + I_C$$

$$I_E = 50\times10^{-6} + 6.4\times10^{-9}$$

$$\boxed{I_E = 5.00064\times10^{-5}}$$

iii.

Same as question no # 02

Scanned with CamScanner

Scanned with CamScanner

Date:

Name:- Maham

Rollno:

2469

Assignment:

'Physics'

Date:

Subjective Part

Past Paper 2021

Q#3, (c), and Q4 (a, b)

Question no

— (3) —

— (a) —

(What is meant)*

— (c) —

A silicon diode has a forward voltage drop of 1.2V for a forward dc current of 100mA. It has a reverse current of 1uA for the reverse voltage of 10V. Calculate. Bulk and reverse resistance of the diode.

Given data:

Silicon diode has a forward Voltage = V = 1.2V

Current = I = 100mA

Date:

Reverse current = 1μA

Reverse voltage = 10V

Find:

Bulk and reverse resistance of diode = ?

Calculation:

Forward resistance of diode.

$$= Rf = \frac{\text{forward voltage drop}}{\text{forward DC current}}$$

$$Rf = \frac{1.2V}{100mA} = 12\Omega$$

Reverse resistance of diode, Rr

$$Rr = \frac{\text{Reverse Voltage}}{\text{Reverse current}}$$

$$Rr = \frac{10V}{1\mu A}$$

$$Rr = 10.M\Omega$$

Therefore the bulk resistance of the diode is equal to the forward resistance, $Rb = Rf = 12\Omega$ and the reverse resistance of the diode is equal to the reverse resistance / $Rr = 10M\Omega$.

Scanned with CamScanner

Date:

Question no 4:

(a)

What is voltage multiplier? Discuss the working of half-wave voltage doubler.

A voltage multiplier is a circuit that generates a high DC voltage from a low AC voltage source, by multiplying the voltage multipliers are commonly used in electronic devices such as cathode ray Tube (CRT) Televisions, X-ray machines, and other high voltage applications.

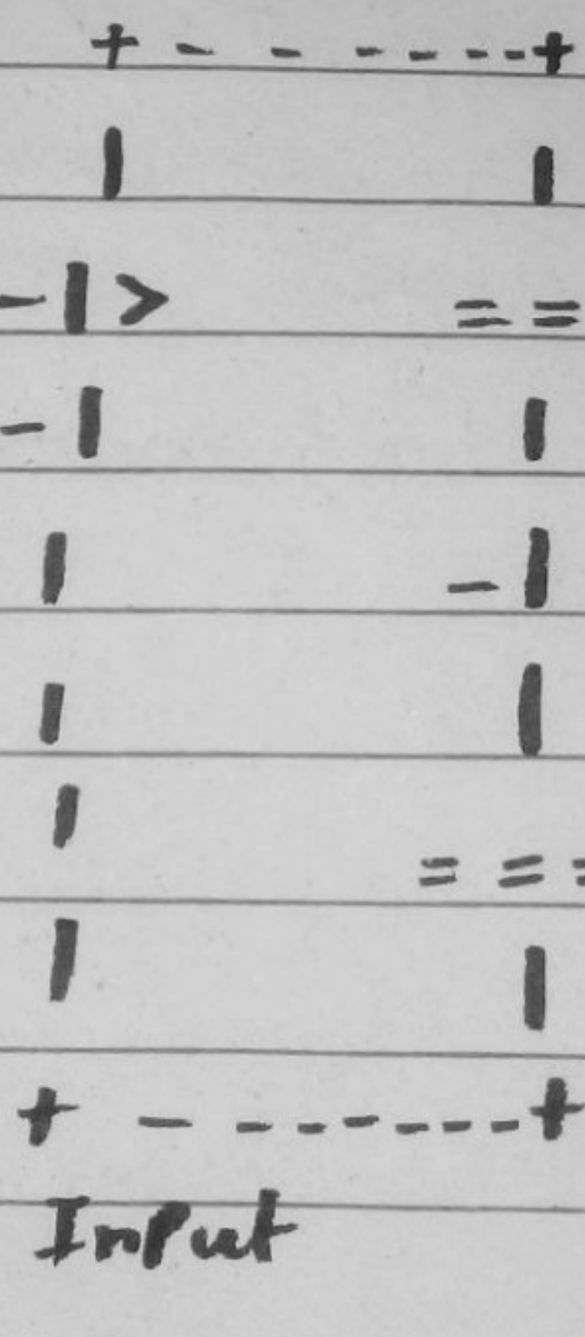
Working of half wave voltage:

A half wave Voltage doubler is a type of voltage multiplier circuit that doubles the input voltage, by using a combination of diodes and capacitors. The circuit works by charging a capacitor through a diode during the

Date:

Positive half cycle of the input AC voltage, and then discharging the capacitor through a second diode during the negative half cycle of the input voltage. This results in a voltage accross the capacitor that is double the input voltage.

The circuit diagram of a half wave voltage doubler :-



Scanned with CamScanner

Date:

During the Positive half cycle of the input voltage, diode D1 conducts and charges capacitor C1 to the Peak value of the input voltage. During the negative half cycle of the input voltage, diode D2 conducts and the voltage, resulting in a voltage across the output of 2times the Peak value of the input voltage. the voltage multiplier circuit requires a sufficiently high input voltage to operate, and may require additional components such as voltage regulators to ensure stable output voltage.

—(b)—

Draw transistor circuit configuratio and determine the relation between α and β.

Date:

Where:

- Q1: NPN Transistor
- RC: Collector resistor
- Vcc: Power supply voltage
- Vout: Output voltage

The relationship between alpha (α) and beta (β) can be expressed as:

$\beta = \alpha / (1 - \alpha)$

where:

- a: Common emitter current gain
- B: Common base current gain

The common emitter current gain(α) is defined as the ratio of the change in collector current (ΔI_c) to the change in emitter current (ΔI_e) with the base-emitter voltage (V_{be})

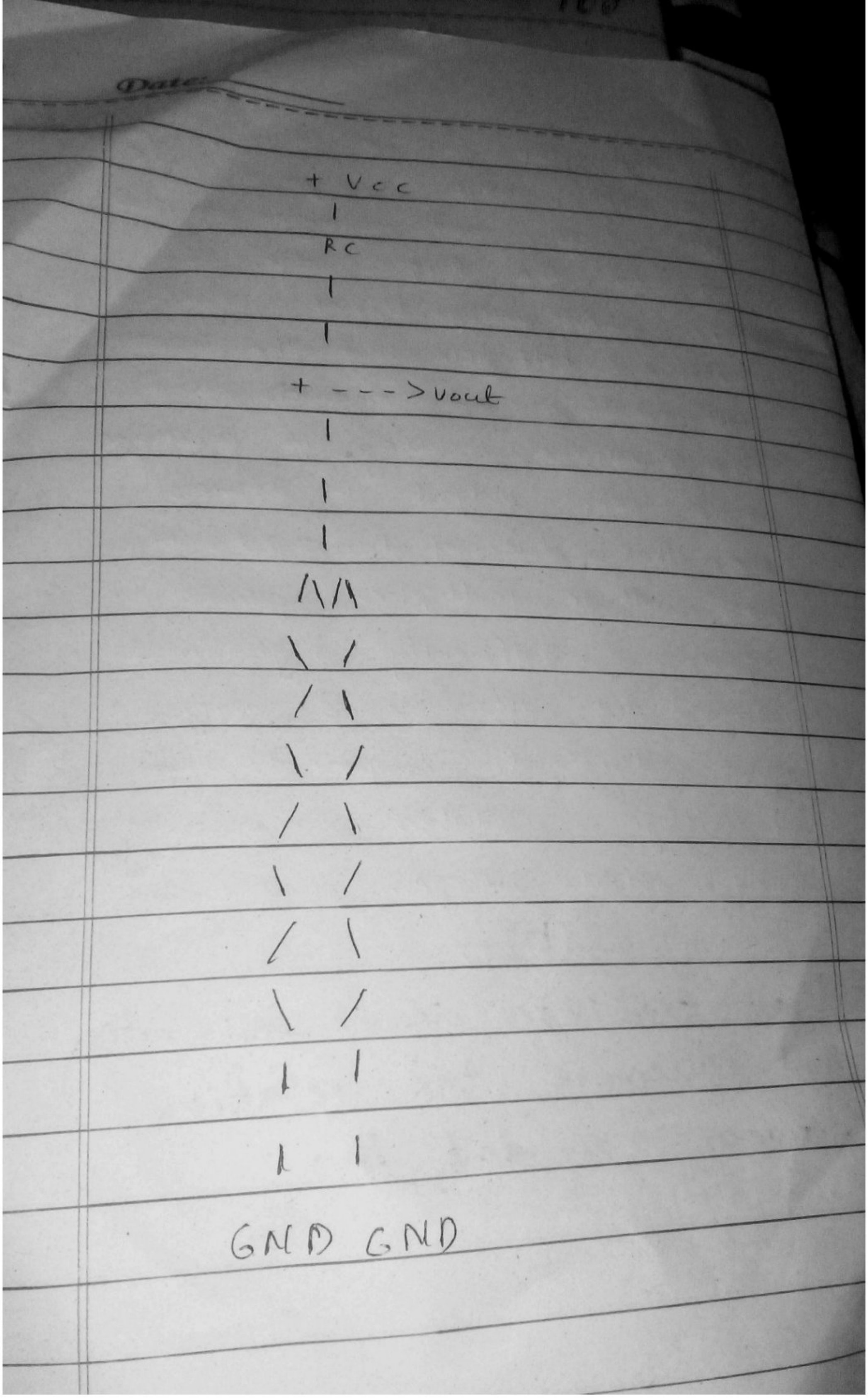
$$\alpha = \Delta I_c / \Delta I_e$$

$$\beta = \Delta I_c / \Delta I_b \ (V_{ce} \text{ constant})$$

$$\beta = \alpha / 1 - \alpha$$

Therefore the relationship between alpha and beta β in a common emitter transistor circuit is given by $\boxed{\beta = \alpha / 1 - \alpha}$

Scanned with CamScanner



Scanned with CamScanner

Date _____ Day M T W T F S

Past paper 2021

Question no. 06

- What is the difference between modulation and de-modulation. State different types of modulation.

Modulation and demodution are two fundamental processes of adding information to a carrier signals, while demodulation is the process of extracting the information from the modulated signal.

- There are several types of modulation, including:
- **Amplitude Modulation:**

In this type of modution, the amplitude of the carrier signal is varied in accordance with the information signal.

Day M T W T F S Date

Date

- **Frequency Modulation:**
In FM the frequency of the carrier signal is varied in accordance with the information signal.
- **Phase modulation:**
In PM, the phase of the carrier signal is varied in accordance with the information signal.
- **Quadrature Amplitude Modulation (QAM):**
QAM is a combination of amplitude and phase modulation. In QAM both the amplitude and phase of the carrier signal are varied in accordance with the information signal.
- **Single Sideband Modulation (SSB):**
SSB is the type of modulation where only one sideband of the carrier signal is transmitted,

Date _____ Day M T W T F S

resulting in a more efficient use of the available bandwidth.

- **Pulse Amplitude Modulation (PAM):**

PAM is a type of modulation where the amplitude of the pulses is varied in accordance with the information signal.

- **Pulse width Modulation (PWM):**

In (PWM), the width of the pulses is varied in accordance with the information signal.

2 **What is difference between real and ideal diode?**

A real diode is a semiconductor device that conducts electric current

Scanned with CamScanner

Day M T W T F S

Date

primarily in one direction. it has a nonlinear current - voltage characteristics meaning that the voltage across the diode and the current flowing through it are related in a way that depends on the materials and structure of the diode. Real diode have some inherent limitations, such as a finite forward voltage drop and a reverse breakdown voltage that can cause the diode to fail.

- An ideal diode, on the other hand, is a hypothetical device that would have perfect eletrical properties, with zero forward voltage drop and an infinite reverse breakdown voltage.

Question # 06 :

Past (b)

An audio signal given by $15\sin 2\pi(2000)t$. amplitude-modulates a sinusoidal sine wave $60\sin 2\pi(100,000)t$. determine

(a) Modulation index

(b) percent modulation

(c) frequency of ~~sigg~~ signal and carries

(d) Channel width

Solution :

Here, $B = 15$ and $A = 60$

(a) Modulation index = MI

$$MI = \frac{B}{A} \Rightarrow \frac{15}{60}$$

$$\boxed{MI = 0.25}$$

(b) percent modulation = m

$$m = MI \times 100 \Rightarrow 0.25 \times 100$$

$$\boxed{m = 25\%}$$

(c)

frequency of signal = f_m = 2000Hz

- by inspection of the given equation

frequency of carrier = f_c = 100,000 Hz

- by inspection of given equation

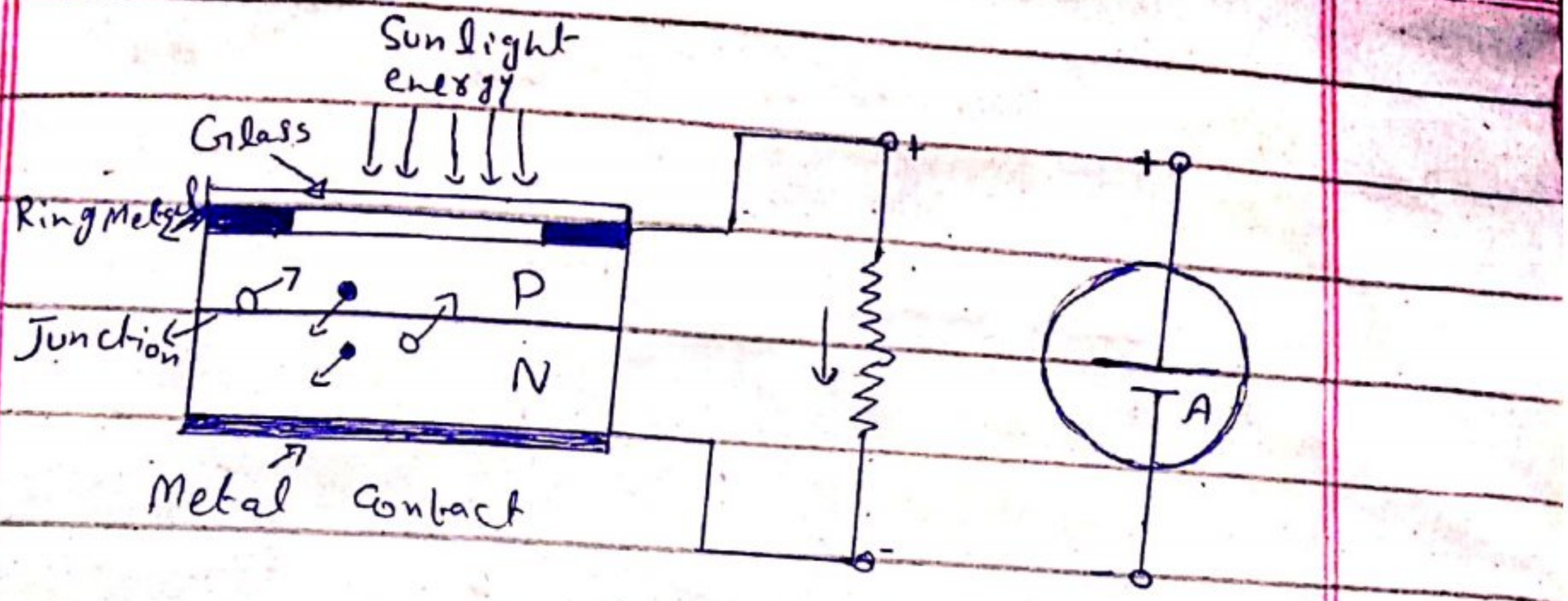
(d) = width of channel

Part (c) :-

What is solar cell? Discuss the working of solar cell.

Solar cell : It is also called solar energy converter and is basically a P-N Junction device which converts solar energy into electric energy.

Working : As shown in fig(a), it is en essentially consists of silicon P-N junction diode generaly put package in To-type can with a glass window on Top Surface



layer of P-material is made extremely thin so that incident light photons may easily reach the P-N junction. when these photons collide with valence electrons, they impart them sufficient energy so to leave their parent atoms. In this way, free electrons and holes are generated on both sides of the junction and their flow constitutes the minority current. This current is directly proportional to the illumination (mW/cm²) and also depends on the size of the surface area being illuminated. The open-circuit voltage V_{oc} is a function of illumination. Consequentely, power output of solar cell depends on the level of sunlight ~~illu~~ illumination. Power cells are also available in flat strip form so as to cover sufficientely.

large surface area. The ~~mickle~~ nickel pad plated ring around the p-layer act as the positive output terminal (anode) and the metal contant at the bottom serves as the negative output terminal (cathode). The symbol is shown in fig (b). Si and Ge are the most widely used semiconductor materials for solar cell although gallium arsenide (GaAs), indium arsenide (InAs) and cadmium arsenide (CdAs) are also being used now-a-days.

University of Sargodha

BS 1st Semester/Term Exam 2021

Subject: I.T/ C.S **Paper: Applied Physics/Basic Electronics (PHYS -101 / PHY-2210)**

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

Note: ***i) Objective part is compulsory. Attempt any three questions from subjective part.***
ii) The marks of the students, who are repeating the course, will be converted according to 80 marks (for non-practical courses)/60 marks (for practical courses).

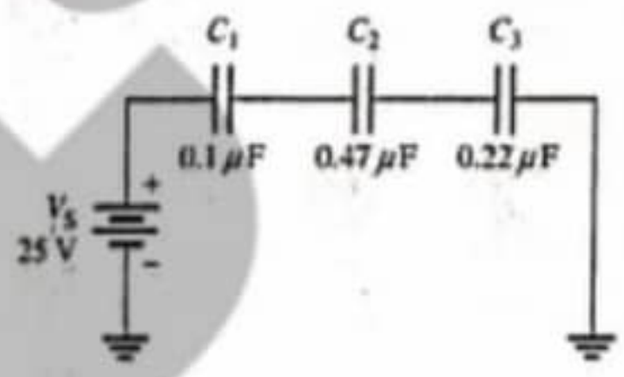
Objective Part (Compulsory)

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

i. Give the advantages of PIN photodiodes.
ii. How the op-amp comparator should be chosen to get higher speed of operation?
iii. In an NPN silicon transistor, α=0.995, I_E=10mA and leakage current I_{CBO}=0.5μA. Determine I_{CEO}
iv. In a BJT, the collector current is 12 mA and the emitter current is 1.02 times the collector current. Find the base current.
v. Define the different operating regions of transistor.
vi. What is meant by drift current?
vii. Define magnetic reluctance.
viii. What is difference between Zener Breakdown and Avalanche Breakdown.
ix. A Silicon diode passes a current of 100 mA at 1V. Find the bulk resistance.
x. For the common-emitter transistor $\beta = 100$ and I_B= 50μA. compute the value of I_C and I_E.
xi. What are transducers?
xii. How the op-amp comparator should be chosen to get higher speed of operation?

Subjective Part (3*12)

Q.2. a). What is difference between active and passive components? Give some examples of these components.
b). State three quantities which are used to establish ohm's law for magnetic circuits.
c). Find the voltage across each capacitor.



Q.3. a). What is meant by isolated atom, draw the energy levels of an isolated atom?
b). Differentiate solid by using energy band diagram.
c). A silicon diode has a forward voltage drop of 1.2 V for a forward dc current of 100 mA. It has a reverse current of 1μA for the reverse voltage of 10 V. calculate. Bulk and reverse resistance of the diode.

Q.4. a). What is voltage multiplier? Discuss the working of half-wave voltage doubler.
b). Draw transistor circuit configuration and determine the relation between α and β.
c). An AC supply of 230 V is applied to a half-wave rectifier circuit through a transformer of turn ratio 10:1. Find (i) the output d.c. voltage and (ii) the peak inverse voltage. Assume the diode to be ideal.

Q.5. a). What is meant by leakage current in a transistor? How these can be classified. Show that
$I_C = \beta I_B + (\beta + 1)I_{CBO}$.
b). What is difference between intrinsic and extrinsic semiconductor? How extrinsic semiconductors are fabricated.
c). What is difference between real and ideal diode?

Q.6. a). What is difference between Modulation and De-modulation. State different types of modulation.
b). An audio signal given by $15\sin 2\pi(2000)t$. amplitude-modulates a sinusoidal sine wave $60\sin 2\pi(100{,}000)t$. determine modulation index, percent modulation, frequencies of signal and carrier , channel width.
c). What is solar cell? Discuss the working of solar cell.