Date:

M T W T F S S

Past Paper 2020.

① Define current proportional formula.

$$I = \frac{V}{R}$$

② Differentiate b/w transition capacitence and diffusion capacitence?

Transition Capacitence	Diffusion capacitence.
• When P-N junction is reverse biased the depletion region act as an insulator or as a dielectric medium and the P-type and N-type region have low resistence and act as plates.	• Diffusion capacitence occurs in a forward biased P-N junction diode. Diffusion capacitence is also sometimes refered as storage capacitence.
• Thus this P-N junction can be considered as a parallel plate capacitor.	• The diffusion capacitence occurs due to stored charged of minority electrons and minority holes near the

Date: _____

M T W T F S S

- This junction capacitence is called as space storage capacitence and is denoted as CT.

- The depletion region increases with the increase in reverse bias potential the resulting transition capacitence decreases.

depletion region.

- When the width of depletion decreases, the diffusion capacitence increases. The diffusion capacitence value will be in the range of nano farads (nF) to micro farads (μF).

problem with

- The diffusion capacitence is that amount of carriers (and capacitance) is proportional to current Therefore, the higher the current, the higher the capacitence.

(3) Prove that $\beta = \frac{\alpha}{1-\alpha}$

$$\beta = \frac{I_c / I_e}{\frac{I_e - I_c}{I_e}}$$

SHAHEEN

Date:

M T W T F S S

$$\beta = \frac{\alpha}{\frac{I_E}{I_E} - \frac{I_C}{I_E}}$$

$$\beta = \frac{\alpha}{1 - \frac{I_C}{I_E}}$$

$$\beta = \frac{\alpha}{1 - \alpha}$$

Hence proved.

⑥ What is effect of temperature on barrier circuits?

As the temperature increases, the value of the potential barrier is decreasing. The potential barrier has the highest value when temperature is at 300K. At temperature 600K, the potential barrier has the lowest value. The temperature affects the kinetic energy of the carriers.

⑤ Why we need filters in the electronics circuit?

Filters are essential building blocks of any Electronic and Communication Systems

SHAHEEN

Date: _____ M T W T F S S

that alter the amplitude or phase characteristics of a signal with respect to frequency.
Filter is basically linear circuit that helps to remove unwanted components such as Noise, Interference & Distortion from the input signal.

(8) Give at least three application of P-N junction photo diode.

Ans Application:

- As power or rectifier diodes. They convert ac current into dc current for dc power supplies of electronic circuits.
- As signal diodes in communication circuits for modulation and demodulation of small signals.
- As Zener diodes in voltage stabilizing circuits.

(9) Write down the significance of inductor. how it responds in ~~read~~ d.c

Inductors are used as the energy storage device in many switched-mode power supplies to produce DC current. The inductor supplies energy to the circuit to keep current flowing during the

SHAHEEN

Date: _____ M T W T F S S

off switching periods and enables topographies where the output voltage is bigger than the input voltage.

(10) ~~Distinguish betw drift speed & Fermi Speed?~~

How it respond in a.c?

The opposition by the inductor due to the inductive reactance property is proportional to the supply frequency increases the opposition also get increased.

$$X_L = 2\pi f L.$$

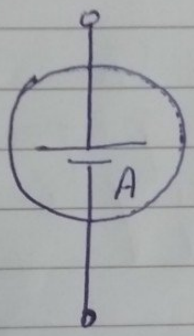
Normally the inductance is negligible at low frequencies but can be troublesome at MHz frequency range.

SHAH

Date:_____ M T W T F S S

(14) Define Solar cell? Draw its symbol.

It is also called solar energy converter & is basically a P-N junction device which converts solar energy into electrical energy.



(15) What are carier waves?
Modulation is a process of combining the low frequency signal with a very high frequency radio wave called carier wave.

OR

It is a high frequency undamped radio wave produced by radio frequency oscillators.

(16) What is Amplitude Modulation?
The amplitude of the sine wave is varied in proportion to the instantaneous

Date: M T W T F S S

amplitude of the information signal or AF signal. Obviously, the amplitude of the carrier wave is changed but not its frequency.
Greater the amplitude of the AF signal, greater the fluctuations in the amplitude of the carrier wave.

(11) Explain effect of doping on semiconductor.
Semiconductor n-type doping creates and fills new energy levels just below the conduction band.
Semiconductor p-type doping creates new energy levels just above the valence band.
The hall effect can be used to determine charge, drift velocity, and charge carrier number density of a semiconductor.

SHAHEEN

Date: _____ M T W T F S S

Past Papers 2020

① Why electrons have greater mobility than holes in semiconductor material?

The ratio of the velocity to the applied field is called the mobility. Since electrons is lighter than holes, they move faster in applied field than holes.

$$\mu_e = \frac{V_e}{\mathcal{E}} \quad , \quad \mu_h = \frac{V_h}{\mathcal{E}}$$

μ_e, μ_h are electrons and hole mobilities: V_e & V_h are electron and hole velocities: $\mathcal{E}$ is applied electric field.

Also free electrons (those moving from one atom to another) are in the conduction band and holes (the lack of an electrons in an orbit) are in the valence band. The conduction band is at a higher level than the valence band and that means that things move faster

The electron mobility is often greater than hole mobility because quite often, the electrons effective mass is smaller than hole effective mass.

SHAHEEN

Date: _____ M T W T F S S

The relaxation times are often of the same order of magnitude for electrons and holes and therefore, they don't make too much difference.

(11) Why PIN photo diodes have faster response time than even the P-N photo diode.

P-I is a three region reverse-biased junction diode. A layer of intrinsic Si is sandwiched b/w two heavily doped P and N-type Si materials. This has the effect of reducing transit time of photo induced electron-hole pairs. P-I is so because carriers generated by light photons incident in the middle of the I-layer have less distance to travel than if generated at one or the other side of the layer. Hence, such diodes have faster response than even the P-N photodiode. Thick I-layer (about 2.5 μm) ensures the absorption of most of the incident light. PIN photodiodes are ultrafast having a switching speed of nanosecond (10^{-9}).

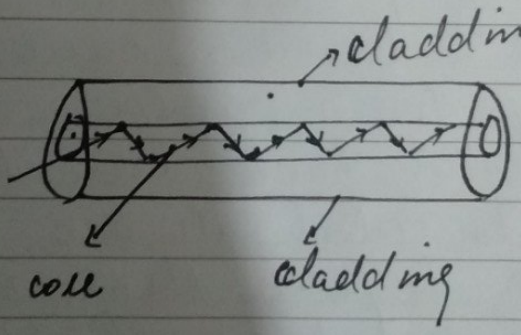
(12) In an optical fibre why refractive index of core is kept higher than cladding.

SHAHEEN

Date: _____ M T W T F S S

An ~~applied~~ optical fibre (of) is a transparent rod usually made of glass or clean plastic through which light can propagate.

A modern fibre consists of an optical rod core coated with a cladding. The refractive index of the rod is higher than the refractive index of cladding material in order ~~to~~ to utilize the phenomenon of total internal reflection for the propagation of the light through the rod.



n_1 = core refractive index
n_2 = cladding refractive index.

$n_1 > n_2$

(10) Distinguish b/w drift speed & fermi speed?

Date: _____ M T W T F S S

Drift speed:

In physics, a drift velocity is the average velocity attained by charged particles, such as electrons, in a material due to an electric field. In general, an electron in a conductor will propagate randomly at the fermi velocity, resulting in an average velocity of zero.

Formula:

$$V_d = \frac{I}{nA}$$

V_d = drift velocity
I = current flow
n = free electron density
e = charge of an electron
A = cross sectional area.

Fermi speed:

In metals, the fermi energy gives us information about the velocities / speed of e's which participate in ordinary electrical conduction. The amount of energy which can be given to an electron in such conduction process is of the order of micro-electron volts. like Cu (copper). So only those electrons very close to fermi energy can participate the fermi speed of

SHAHEEN

Date: _____ M T W T F S S

those electrons can be calculated from the fermi energy.

$$v_f = \sqrt{\frac{2\varepsilon_f}{m}}$$

This speed is a part of the microscopic Ohm's law for electrical conduction. For a metal, the density of conduction electrons can be implied from the fermi energy.

(13) Under what condition a transistor can operate in an active region?

A transistor is said to be in its active mode of it is operating some where b/w full on (saturated) & fully off (cut-off) Base current (i_B) regulates collector current.

By regulate, we mean that no more collector current can exist than what is allowed by the base current. Unlike the resistors, which have a linear relation b/w voltage and current, the transistor are non linear devices. In order to operate in active mode,

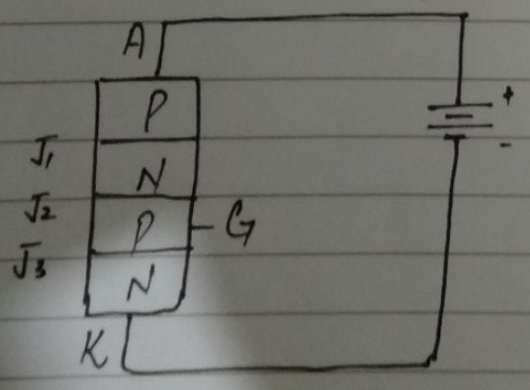
Date: _____ M T W T F S S

Transistor's base voltage in base-emitter junction must be greater than zero, ~~which~~ while in base-collector mode must be negative.

extra Short Q/A.

Define Silicon-controlled rectifier with its symbolic representation.

- A silicon controlled rectifier (SCR) or semiconductor controlled rectifier (SCR) is a four-layer solid states current controlling device which forms PNPN or NPNP structure, it has three junction J_1, J_2, J_3 and three terminals. The anode terminal of SCR is connected to P-type and cathode is connected to N-type. The gate is connected to P-type material near to cathode.



A = Anode
K = Cathode

SHAHEEN

Date:_____ M T W T F S S

Q. Define ripple factor.

The output of the rectifier is consisting of a dc component and ac component. This ac component is undesirable and cause for the pulsations in the rectifier output. The ripple factor is a measure of the quality of the rectification of an AC current.

Ripple factor (γ) may be defined as the ratio of the root mean square (rms) value of the ripple voltage to the absolute value of the DC component of the output voltage usually expressed as percentage.

However, ripple voltage is also commonly expressed as the peak to peak value.

SHAHEEN