University of Sargodha

BS 1st Term Exam 2016

Subject: Information Technology **Course: Basic Electronics (PHY-2210)**

Time Allowed: 2:30 Hours **Maximum Marks: 80**

Objective Part Compulsory

Q.No.1: Attempt all parts and each require answer 2 – 3 lines (16*2=32)

1) Express voltage proportional formula for two resistances connected in series?

The voltage across each resistor connected in series follows different rules to that of the series current.

$V_{Total} = V_1 + V_2 + V_3 \ldots\ldots + V_n$ and

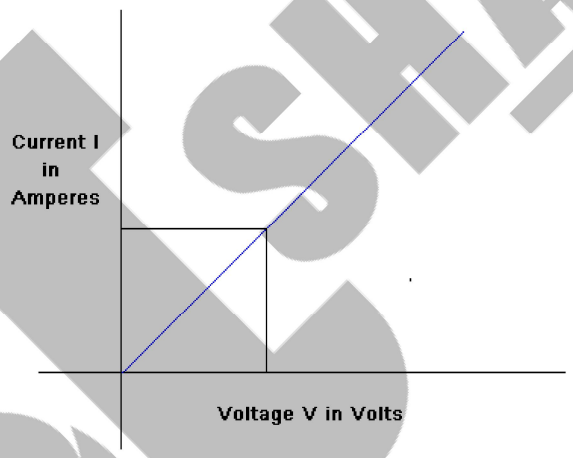
$V_1 = IR_1$, $V_2 = IR_2$ $V_n = IR_n$

2) Why we need filters in electronic circuits?

Electronic circuits used to perform signal processing functions, specifically to remove unwanted frequency components from the signal, to enhance wanted ones, or both. Their purpose is:

- To select the desire frequency (or band of frequencies) from a complex input 0000000wave.
- To reject the undesired frequency (or band of frequencies).
- To apply only the desired frequency component to the circuit where it is required.

3) How Ohm's law can be expressed graphically for linear resistors?



4) Briefly describe total internal reflection.

Total internal reflection, in physics, complete reflection of a ray of light within a medium such as water or glass from the surrounding surfaces back into the medium. The phenomenon occurs if the angle of incidence is greater than a certain limiting angle, called the critical angle. In general, total internal reflection takes place at the boundary between two transparent media when a ray of light in a medium of higher index of refraction approaches the other medium at an angle of incidence greater than the critical angle. For a water-air surface the critical angle is 48.5°.

5) Can a transformer operate on DC?

NO, transformers cannot operate on DC. Transformers work in the principle of Faraday's law of "mutual induction", in which an EMF is induced in the transformers secondary coil by the magnetic flux generated by the voltages and currents flowing in the primary coil winding.

As in DC (voltage being always constant) the change in flux is zero so no mutual induction, thus transformers can't work with a DC supply. Moreover, if DC of similar rating of AC (Voltage & Current) is fed into the terminals of a Transformer there is a high possibility that it would burn the primary coil.

6) What is the difference between electron and hole?

Electron: The subatomic particle having a negative charge and orbiting the nucleus; the flow of electrons in a conductor constitutes

Hole: hole is a hollow spot in a surface. An electron hole is just the lack of an electron, not an antiparticle... or a particle at all.

7) Why we use cells in series and parallel connection?

Cells are used in series combination when higher voltage is required. Because the total voltage in series circuit is sum of all voltages of cells. And cells are used in parallel connection when higher current is required instead of voltage.

8) Mention at least five different energy sources?

i. Solar Energy
ii. Wind Energy
iii. Geothermal Energy
iv. Hydrogen Energy
v. Tidal Energy
vi. Wave Energy
vii. Hydroelectric Energy
viii. Biomass Energy

9) Give two application of transformers.

I. To step up and step down the voltage level in Electric transmission, distribution. Voltage Regulator: This can easily be seen at your home for over voltage protection.
II. Welding Machine: Transformer reduces the voltage level and increases the Current in welding process. It converts 230 V AC, to 17–45 V AC and 55–590 Amp high current.
III. Rectification: The rectification process does AC to DC conversion. Rectification is important for HVDC transmission. The most common type of rectifier is your mobile charger.

10) Briefly describe how electrons are multiplied in photomultiplier tube?

Photomultipliers are extremely sensitive detectors of light including visible light, ultraviolet light and near infrared. Photons enter the photomultiplier tube and strike the photocathode. When this occurs, electrons are produced as a result of the photoelectric effect.

Once the electrons have been generated, they are directed towards an area of the photomultiplier called the electron multiplier. As the name suggests, this area serves to increase or multiply the number of electrons by a process known as secondary emission.

This operates by pulling electrons progressively towards the more positive areas in the following way. The electrons leave the photocathode with the energy received from the incoming photon. They move towards the first dynode and they are accelerated by the electric field and they arrive with much greater energy than they left the cathode. When they strike the first dynode more low energy electrons are released, and these are in turn attracted by the greater positive field of the next dynode, and these electrons are similarly accelerated by the greater positive potential of the second dynode, and this process is repeated along all the dynodes until the electrons reach the anode where they are collected.

11) Why optical fibers are better than metallic wires?

i. Greater Bandwidth: Copper cables were originally designed for voice transmission and have a limited bandwidth. Fiber optic cables provide more bandwidth for carrying more data than copper cables of the same diameter.
ii. Faster Speeds: Fiber optic cables have a core that carries light to transmit data
iii. Longer Distances: Fiber optic cables can carry signals much farther than the typical 328-foot limitation for copper cables.

iv. Better Reliability: Fiber is immune to temperature changes, severe weather and moisture, all of which can hamper the connectivity of copper cable. Plus, fiber does not carry electric current, so it's not bothered by electromagnetic interference (EMI) that can interrupt data transmission

v. Thinner and Sturdier: Compared to copper cables, fiber optic cables are thinner and lighter in weight. Fiber can withstand more pull pressure than copper and is less prone to damage and breakage.

12) Differentiate mobile charge carriers and immobile ions.

Mobile charge carriers: A charge carrier is a particle free to move, carrying an electric charge, especially the particles that carry electric charges in electrical conductors. Examples are electrons, ions and holes.

Immobile ions: Immobile ions are those particles which does not have the ability to move.

13) What is the effect of doping level on width of depletion layer?

(Higher the doping the thinner will be depletion layer)

Doping means adding impurities to the semiconductor to improve its electrical conductivity. When we add large amount of impurities to the semiconductor, it will produce large number of free electrons in the n-type semiconductor and large number of holes in the p-type semiconductor.

The large number of free electrons in the n-type semiconductor repels from each other and try to move towards p-side. However, before entering into p-side, the free electrons meet positive ions at the depletion region. We know that positive ions are ready to accept extra electrons. When the positive ions accept the extra electrons, they become neutral atoms. In this manner large number of free electrons fills the holes in positive ions and makes them neutral.

In the similar way, holes moving from p-side to n-side meets the negative ions and makes them neutral atoms. In this manner, free electrons and holes reduce the ions. Reduction of positive ions means reduction of depletion region. Thus, the depletion region decreases.

14) On what facts inductance of an inductor depends?

Inductance of an inductor depends upon the following:

I. Number of wire wraps, or "turns" in the coil: the more turns in coil causes more inductance.

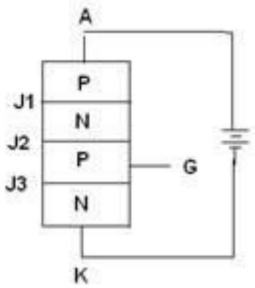
II. Coil area: greater coil area results in greater inductance; less coil area results in less inductance.

III. Coil length: the longer the coil's length, the less inductance; the shorter the coil's length, the greater the inductance.

IV. Core material: a core material with greater magnetic permeability results in greater inductance.

15) Define silicon-controlled rectifier with its symbolic representation?

A silicon-controlled rectifier or semiconductor-controlled rectifier is a four-layer solid-state current-controlling device. Which forms PNPN or NPNP structure, it has tree junction J1. J2 and J3 and three terminals. The anode terminal of SCR is connected to the P-type and cathode is connected to the N-type. The gate is connected to the P-type material near to the cathode.



16) Define ripple factor.

The output of a rectifier is consisting of a dc component and an 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 a percentage. However, ripple voltage is also commonly expressed as the peak-to-peak value.

Subjective Part (4x12=48)

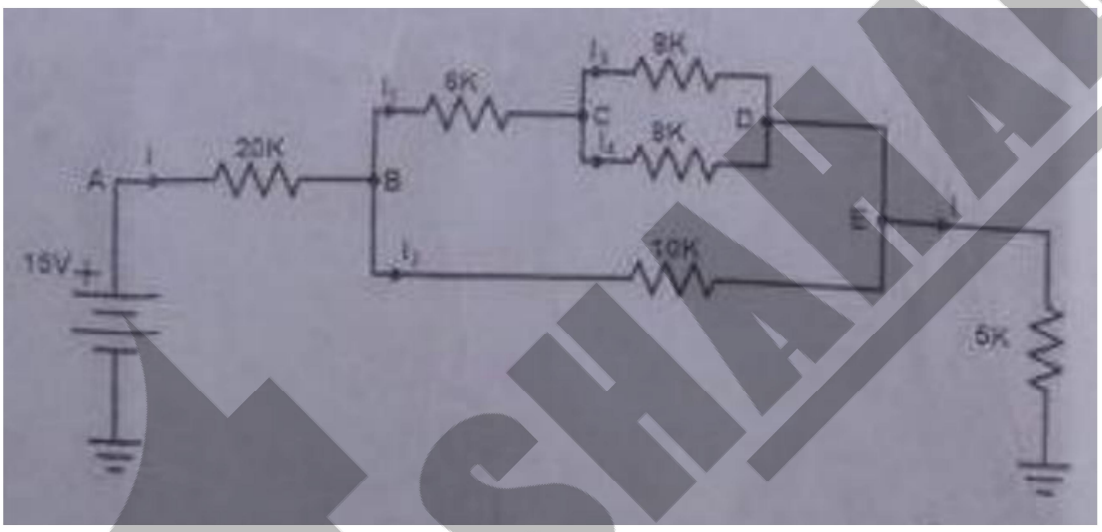
Q2. Define modulation? Explain frequency modulation in detail.

Q3. What is rectifier? Draw circuit diagram of full wave bridge rectifier and explain its working.

Q4. Draw and explain the forward and reverse characteristics curve of PN-Junction diode; discuss this on graph V_{br} (barrier voltage) and V_{sat} (saturation current).

Q5. Draw the transistor and equivalent model of SCR, with the help of this model, explain the working of SCR also mention its application.

Q6. Compute (1) equivalent resistance (2) branch currents (3) voltage drop across each resistance.



Q7. Write a note on the characteristics of cells in series and parallel connection.