**491phys: Theory Report**

**Please note that:**

* **Your report must be submitted to me before you start the experiment.**
* **Use white, A4 paper.**
* **The report must be written by your own words. You can add images, figures to support your theory parts.**

***In each report you must discuss all the points mentioned here. Always include the equations you used in the experimental calculations.***

**1-Hall Effect:**

1. Principle of Hall effect
2. Hall effect in metals and semiconductors
3. Doping of semiconductors
4. Electromagnet working principle

**2-Dielectric constant:**

1. Ferroelectricity
2. Perovskite structure
3. dielectric material between the plates of a capacitor
4. Curie-Weiss law
5. Electrical and related structural properties of BaTiO

**3-X-ray diffraction:**

1. X-ray production
2. Crystal structure
3. Bragg law
4. Miller indices
5. Geiger-Muller detector

**4-Electron Diffraction:**

1. De Broglie’s hypothesis
2. Studying structure of crystalline solids by Electron diffraction

**5-The Effect of temperature on metals and semiconductor resistance:**

1. The classical free electron model for metals
2. The quantum free electron model
3. The band theory of solids
4. The dependence of resistivity of metals and semiconductors according to the previous models and theory

**6-Electron spin resonance:**

1. origin of magnetism
2. Classification of materials based on magnetic properties
3. The electron spin resonance (ESR) principle
4. Zeeman effect
5. The difference between the electron spin resonance (ESR) and nuclear magnetic resonance (NMR)

**7-Seebeck effect:**

1. Thermoelectric effect
2. Thermoelectric generator work principle
3. Seebeck effect, Peltier effect, and Thomson effect
4. Positive and negative Seebeck coefficients

**8-X-ray fluorescence (XRF):**

1. Moseley’s law
2. Difference between x-ray diffraction and x-ray fluorescence
3. The meaning of K,L,M and α, β, in the names of the spectral lines in XRF
4. The wavelength dispersive (WDX) and the energy dispersive spectrometer (EDX)

**9- Solar cell**

1. Photovoltaic effect
2. P-n junction
3. Optical properties of silicon p-n junction
4. Effect of illumination on p-n junction under different biasing
5. Components of solar cell

**Some References**

1. Fundamentals of semiconductor Devices, J.Lindmayer and C.Y. Wrigley, Affiliated East-West Press Pvt. Ltd., New Delhi.

2. Introduction to Solid State Physics, C. Kittel; John Wiley and Sons Inc., N.Y. (1971), 4th edition.

3. Experiments in Modern Physics, A.C. Melissios, Academic Press, N.Y. (1966).

4. Electrons and Holes, W. Shockley, D. Van Nostrand ,N.Y. (1950).

5. Hall Effect and Related Phenomena, E.H. Putley, Butterworths, London (1960).

6. Handbook of Semiconductor Electronics, L.P. Hunter (e.d.) McGraw Hill Book Co. Inc., N.Y. (1962).