**NEPAL COLLEGE OF INFORMATION TECHNOLOGY**

***Imadol , Lalitpur***

**COURSE DETAILING AND IMPLIMENTATION WORKSHOP**

***September 20,2002***

**Program: BE (IT/ COMP/SE/ELX & COMM)**

**Semester:III**

**Course:*ELE 226.2 Electrical Engineering Materials (2-2-0)***

**Evaluation:**

|  |  |  |
| --- | --- | --- |
| Theory | Practical | Total |
| Sessional | 50 | - | 50 |
| Final | 50 | - | 50 |
| Total | 100 | - | 100 |

**Course Objectives:**

To provide a basic understanding of the electric and magnetic properties of materials used in electrical and electronics engineering.

**Course Contents:**

**Chapter 1 Theory of Metals (21 hrs)**

***Elementary quantum Mechanical Ideas***

Wave particle duality with relevant experiments and equation. Time independent Schrodinger’s equations and Time dependent. Wave function (Normalized Orthogonal and probability density) Particle in a box (Infinite potential well) equation for  and , Tunnel effect, free electron theory (Definition) Energy well model of metal ( E-K diagram and derivation), Density of state function, Fermi-Dirac distribution, relation between density of electron and fermi energy, Thermionic emission and work function, Richardson’s equation and numericals , contact potential.

Crystal lattice, space lattice, unit cell depending upon geometry of unit cell-7 crystal family & 14 Bravais lattices (concept), Simple cubic, face centered cubic, Body centered cubic, Co-ordinate number, Atomic radius and packing density. Miller indices, lattice scattering, mean free time between collisions, drift velocity of electrons in electric field, diffusion of electrons, diffusion coefficients, Chemical and physical properties of common conducting materials such as Au, Ag, Cu, Al and Mn.

**Chapter 2 Conduction in Liquid and Gases (3 hrs)**

Ionic conduction in electrolytes, electrical conduction in gases, **arc** discharges, electric breakdown.

**Chapter 3 Dielectric Materials (6 hrs)**

Macroscopic effects, Polarization (relative permittivity definition, dipole moment and electronic polarization), Dielectric loss, Claussius-Mossoti equation, Ionic polarization, Orientational polarization (definition only),Dielectric breakdown, Frequency effect, Ferro electricity and piezoelectricity, properties of common dielectrics such as glass, Porcelain, Polyethylene, PVC, Nylon, bakelite, rubber, mica, transformer oil, etc.

**Chapter 4 Magnetic Materials (5 hrs)**

Ferromagnetism, Para magnetism and diamagnetism, domain structure, hysteresis loop, eddy current losses, soft magnetic materials, Fe-Si alloys, Ni-Fe alloys, ferrites for high frequency transformers, square loop materials for magnetic memory, relaxation oscillators, hard magnetic materials such as carbon steels, Al-Ni-Co alloy and barium farrites**.**

**Chapter 5 Semiconducting Materials (14 hrs)**

Definition of group iv materials, Energy gap and introduction of semiconductor, Femi-Dirac distribution, holes and electrons densities in semiconductor, Band theory, Fermi gas Fermi level and equation of ni, po and no in terms of Ec, Ev and Ei. definition of acceptors and donors, Drift velocity, mobility, conductivity, current density and numerical on them. Intrinsic/Extrinsic semiconductor (definition and derivation) diffusion Ficks law, diffusion coefficients, diffusion length ,Einstein’s coefficient for electrons and holes ,contact potentials, Schottky effect metal-semiconductor contacts.

**Chapter 6 Semiconductor Materials Procession (4 hrs)**

Crystal growing, doping by solid state diffusion, ion implantation, oxidation Photolithography, the planar process, metallization, contacts.

**Reference Books:**

1. R.A. Colcaseer And Diehi-Nagle, *Materials and Devices for Electrical Engineers and Physicists*, McGraw-Hill, New York, 1985.
2. R.C. Jaeger, *Introduction to Microelectronic Fabrication-Volume IV*, Addison-Wesley Publishing Company Inc., 1988.
3. S.O. Kasop & Pillai, Electronic Materials and Devices