

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR

Dean (FW)/
Date: 19/7/13

NOTE

Subject: Department course book - reg.

i. General Information about the departments :

Department of Physics is involved in teaching for UG and PG students of Engineering branches in addition to Sciences. The department has highly qualified and experienced faculty who guide UG, PG and Ph.D. students. The department has number of ongoing as well as completed R&D projects. The areas of research include Nanomaterials, Thin films, Glasses and Glass Ceramics, Ferroelectrics, Magnetic materials, Polymers, Computational Physics, Photovoltaics, sensors, supercapacitors & optoelectronic devices etc. The department has sophisticated instrumentation facilities for synthesis, characterization & applications. M.Sc.(Physics) course lays thrust on fundamental pure physics courses and emphasizes applied Physics courses as well as provides courses on topics of recent interest towards R&D.

ii. List of faculty members

SN	Name	Qualification	E-mail id
1	Prof. V.K. Deshpande	M.Sc. Ph.D.	vkdeshpande@phy.vnit.ac.in
2	Dr. R.S. Gedam	M.Sc. Ph.D.	rsgedam@phy.vnit.ac.in
3	Dr. B.R. Sankapal	M.Sc. Ph.D.	brsankapal@gmail.com
4	Dr. G. Hemchandra	M.Sc.(Tech.), M.Phil. Ph.D.	drghc@rediffmail.com
5	Dr. Mrs. S. R Patrikar	M.Sc. Ph.D.	sujata_patrikar@rediffmail.com
6	Dr. Mrs. A.V. Deshpande	M.Sc. Ph.D.	avdeshpande@phy.vnit.ac.in
7	Dr. Mrs. S.M. Giripunje	M.Sc. PGDCA, Ph.D.	smgiripunje@phy.vnit.ac.in
8	Dr. Mohan Kant	M.Sc.M.Tech. Ph.D.	k.mohankant@gmail.com

iii. Scheme of Examination / Instruction –B Tech Branch: Credit requirements:

Category	Credits
Departmental core:	16
Departmental Electives (Higher SEM-B.Tech.)	12
Basic Sciences/ First Year	78
HM	0-6
OC	0-12

iv Detailed syllabus :

Course Number : PHL 101 Course Name : Physics Credits : 6

Black Body Radiations, Photoelectric effect, Compton effect, Concept of matter waves, Davisson and Germer's experiment, Heisenberg's Uncertainty principle, Schrodinger's Wave equation and its application. Quantization of energy.

Crystal Structure : Unit cell and its characteristics in SC , BCC, FCC crystal structure, Miller indices, Bragg's Law, interplaner spacing.

Free electron theory, Formation of energy bands in solid, Fermi level in an intrinsic and extrinsic semiconductor, Hall effect, p-n junction diode, transistors.

Motion of charged particles in electric and magnetic field. Electrostatic and magnetostatic focussing, CRO, Cyclotron.

Interference, diffraction and their applications.

Books Recommended:

1. Resnick, Walker and Halliday, Fundamental of Physics, John Willey and Sons. Inc, 6th Edition, 2005.
2. B. G. Streetman, Solid State Electronics, Prentice Hall India (2nd Edition) 1986
3. M.N. Avadhanulu and P.G. Kshirsagar, A text Book of Engineering Physics, (7th Edition) 2004.
4. Dekkar A.J.; Electrical Engineering Materials; Prentice Hall og India Publication, 1992
5. Kenneth Krane; Modern Physics; (2nd Edition); John Wiley Eastern, 1998
6. S. O. Pillai, Solid State Physics, New Age International Publishers, 3rd edition, 1999

Course Number : PHL 203 Course Name : Electronic Materials Credits : 6

Dielectric properties of insulators in static fields, Polarization, Dielectric constant, Dielectric behavior of materials, Ferroelectric, Piezoelectric and Pyroelectric materials,

Dielectric properties of insulators in alternating fields, Complex dielectric constant, Dipolar relaxation, Dielectric loss, Loss tangent, Dielectric break down, different types of capacitor, multilayer capacitors, Ferroelectric polymers.

Conductivity of pure metals and alloys, Temperature coefficient of resistivity, High conductivity materials, Fixed and variable resistors, Resistors used in electronic circuits,

Magnetic materials classification, Soft and Hard magnetic materials, Ferrites, Magnetic cores of transformers, Relays, memory elements, Magnetic resistors and Magnetic tapes mutliferroic materials Superconductivity, Type-I and Type-II superconductors, High temperature superconductivity, Applications of superconductivity.

Text / Reference

1. Dekkar A.J.; Electrical Engineering Materials; Prentice Hall of India Publications, 1992
2. Seth S.P.; A course in Electrical Engineering Materials; (Third edition)Dhanpatrai Publications,2003
3. Joshi M.A.; Electronic components and materials; SPD Publications
4. Pillai S.O.; Solid State Physics; New Age Publication, 1999
5. Kasap S.O.; Principles of Electronic Materials and Devices; Tata-Mcgraw-Hill, 2002

Course Number : PHL202 Course Name : Introductions to material science Credits : 6

Electrical Conduction: Electronic and Ionic conduction, conductivity in metals, relaxation time , collision time , mean free path of an electron , electron scattering , resistivity of metals, high conducting and resistive materials. Superconductivity and applications.

Polarization of Dielectrics: Basic concept of polarization, Types of polarization, Dielectric constant, Internal field in dielectrics, Ferroelectric, Spontaneous polarization, Curie-Weiss law, Piezoelectric and Pyroelectric.

Dielectric in Alternating field: Complex dielectric constant, Electronic Frequency dependence of electronic polarization .Dielectric constant of non-polar solids, Dipolar relaxation, loss tangent and dielectric breakdown.

Magnetic Properties of Materials: Classification of magnetic materials, Ferromagnetic domain, materials for rotating machines, transformers , permanent magnets, Nonmetallic magnetic materials , thin film magnets , magnetic materials for ferromagnetic tape and memory devices, spintronics, superconductivity and applications.

Fabrication of Integrated circuits.

Text Books:

1. A.J.Dekkar, Electrical Engineering Materials, Prentice Hall Publications Co.
2. S.O. Kasap, Principle of Electronic Materials and Devices, (2nd Edition), TATA McGraw- Hill
3. D.Roy Choudhary, Shail Jain, Linear Integrated Circuits, New Age International (P) Limited, Publishers

Reference Books:

1. S. O. Pillai, Solid State Physics, New Age International Publishers, 3rd edition, 1999

Course Number : PHL 305 Course Name : Electrical & Magnetic Materials Credits : 6

Electrical Conducting Materials: Conduction in Metals: Free electron theory, Ohm's Law, Joule's Law, Factors affecting electrical resistivity of metals. Properties of Coppers, Brass, Aluminum, Materials for conducting applications, , Thermistors, varistors, Ionic conductors, Superconductors, Silsbee's rule, Meissner effect, type - I and type -II superconductors, Applications of Superconductors.

Dielectric Materials: Fundamental concepts, Types of Polarization, electronic, ionic, orientational, polarization polar and non-polar dielectrics, ferroelectricity and piezoelectricity spontaneous polarization, Curie-Weiss law, Electroceramics, processing and application of electroceramics, Transducers.

Magnetic Materials: Concept of Magnetism, Classification of magnetic materials, diamagnetic, paramagnetic, ferromagnetic, anti-ferromagnetic and ferrimagnetic materials. Spontaneous magnetization, ferromagnetic domains soft magnetic & hard magnetic materials, ferrites.

Introduction, Classification & Application of Ferroic materials

Text / Reference

1. Dekkar A.J.; Electrical Engineering Materials; Prentice Hall of India Publication, 1992
2. Kenneth Krane; Modern Physics; (2nd Edition); John Wiley Eastern, 1998
3. Kasap S.O.; Principles of Electronic Material and Devices; Tata-Mcgraw-Hill, 2002