BSc (PCM)

DETAILED SYLLABUS

Semester-VI
Physics

BPH 601	L	T	P	C
Solid State Physics	3	0	0	3

Unit I- Crystal Structure & Lattice Dynamics

Amorphous and Crystalline Materials. Lattice Translation Vectors. Lattice with a Basis – Central and Non-Central Elements. Unit Cell. Reciprocal Lattice. Types of Lattices. Brillion Zones. Types of Bonds. Ionic Bond. Covalent Bond. Van der Waals Bond. Diffraction of x-rays by Crystals. Bragg's Law. Lattice Vibrations and Phonons: Einstein and Debye Theories of Specific Heat of Solids. T^3Law.

Unit II- Dielectric & Magnetic Properties of Matter

Dia-, Para-, Ferri- and Ferromagnetic Materials. Classical Langevin Theory of dia – and Paramagnetic Domains. Quantum Mechanical Treatment of Para magnetism. Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains. Polarization.. Dielectric Constant. Electric Susceptibility. Polarizability. Complex Dielectric Constant.

Unit III- Electrical Properties of Materials

Elementary Band Theory of Solids. Bloch Theorem. Kronig-Penney Model. Effective Mass of Electron. Concept of Holes. Band Gaps. Energy Band Diagram and Classification of Solids. Law of Mass Action. Insulators, and Semiconductors. Direct and Indirect Band Gap. Intrinsic and Extrinsic Semiconductors. p- and n- Type Semiconductors. Conductivity in Semiconductors. Hall Effect in Semiconductors .

Unit IV- Superconductivity

Experimental Results. Critical Temperature. Critical magnetic field. Meissner effect. Type I and type II Superconductors, London's Equation and Penetration Depth. Isotope effect. Idea of BCS theory (No derivation): Cooper Pair and Coherence length. Variation of Superconducting Energy Gap with Temperature. Experimental Evidence of Phonons. Josephson Effect.

Reference Books:

1. Charles Kittel, Introduction to Solid State Physics, 7th Edition, John Wiley and Sons, Inc.
2. A J Dekkar, Solid State Physics, Macmillan India Limited, 2000.
3. J. S. Blackmore, Solid State Physics, Cambridge University Press, Cambridge.
4. N. W. Ascroft and N. D. Mermin, Solid State Physics, (Harcourt Asia, Singapore, 2003).

5. M. Ali Omar, Elementary solid state physics: principles and applications, (Pearson Education, 1999)

BPH 602	L	T	P	C
Radiation Safety	2	0	0	2

Basics of Atomic and Nuclear Physics: Basic concept of atomic structure; X rays characteristic and production; concept of bremsstrahlung and auger electron, The composition of nucleus and its properties, mass number, isotopes of element, spin, binding energy, stable and unstable isotopes, law of radioactive decay, Mean life and half life, basic concept of alpha, beta and gamma decay, concept of cross section and kinematics of nuclear reactions, types of nuclear reaction, Fusion, fission.

Interaction of Radiation with matter: Types of Radiation: Alpha, Beta, Gamma and Neutron and their sources, sealed and unsealed sources, **Interaction of Photons** – Photoelectric effect, Compton Scattering, Pair Production, Linear and Mass Attenuation Coefficients, **Interaction of Charged Particles:** Heavy charged particles - Beth-Bloch Formula, Scaling laws, Mass Stopping Power, Range, Straggling, Channeling and Cherenkov radiation. Beta Particles- Collision and Radiation loss (Bremsstrahlung),

Interaction of Neutrons- Collision, slowing down and Moderation.

Radiation detection and monitoring devices: Radiation Quantities and Units: Basic idea of different units of activity, KERMA, exposure, absorbed dose, equivalent dose, effective dose, collective equivalent dose, Annual Limit of Intake (ALI) and derived Air Concentration (DAC).

Radiation detection: Basic concept and working principle of *gas detectors* (Ionization Chambers, Proportional Counter, Multi-Wire Proportional Counters (MWPC) and Gieger Muller Counter), *Scintillation Detectors* **(**Inorganic and Organic Scintillators), *Solid States Detectors* and *Neutron Detectors, Thermo luminescent Dosimetry.*

Radiation safety management: *Biological effects of ionizing radiation*, Operational limits and basics of radiation hazards evaluation and control: radiation protection standards, International Commission on Radiological Protection (ICRP) principles, justification, optimization, limitation, introduction of safety and risk management of radiation. Nuclear waste and disposal management. Brief idea about Accelerator driven Sub-critical system (ADS) for waste management.

Application of nuclear techniques: Application in medical science (e.g., MRI, PET, Projection Imaging Gamma Camera, radiation therapy), Archaeology, Art, Crime detection, Mining and oil. *Industrial Uses:* Tracing, Gauging, Material Modification, Sterization, Food preservation.

Practice

1. Study the background radiation levels using Radiation meter
2. Study of gamma spectrum of Gas Light mantle (Source of Thorium)

Reference Books:

1. W.E. Burcham and M. Jobes – Nuclear and Particle Physics – Longman (1995)
2. G.F.Knoll, Radiation detection and measurements
3. Thermoluninescense Dosimetry, Mcknlay, A.F., Bristol, Adam Hilger (Medical Physics Handbook 5)

4. W.J. Meredith and J.B. Massey, “Fundamental Physics of Radiology”. John Wright and Sons, UK, 1989.
5. J.R. Greening, “Fundamentals of Radiation Dosimetry”, Medical Physics Hand Book Series, No.6, Adam Hilger Ltd., Bristol 1981.

BPH-603	L	P	T	C
Physics Workshop Skill	**2**	**0**	**0**	**2**

Introduction: Measuring units. conversion to SI and CGS. Familiarization with meter scale, Vernier calliper, Screw gauge and their utility. Measure the dimension of a solid block, volume of cylindrical beaker/glass, diameter of a thin wire, thickness of metal sheet, etc. Use of Sextant to measure height of buildings, mountains, etc.

Mechanical Skill: Concept of workshop practice. Overview of manufacturing methods: casting, foundry, machining, forming and welding. Types of welding joints and welding defects. Common materials used for manufacturing like steel, copper, iron, metal sheets, composites and alloy, wood. Concept of machine processing, introduction to common machine tools like lathe, shaper, drilling, milling and surface machines. Cutting tools, lubricating oils. Cutting of a metal sheet using blade. Smoothening of cutting edge of sheet using file. Drilling of holes of different diameter in metal sheet and wooden block. Use of bench vice and tools for fitting. Make funnel using metal sheet.

Electrical and Electronic Skill: Use of Multimeter. Soldering of electrical circuits having discrete components (R, L, C, diode) and ICs on PCB. Operation of oscilloscope. Making regulated power supply. Timer circuit, Electronic switch using transistor and relay.

Introduction to prime movers: Mechanism, gear system, wheel, Fixing of gears with motor axel. Lever mechanism, Lifting of heavy weight using lever. braking systems, pulleys, working principle of power generation systems. Demonstration of pulley experiment.

Reference Books:

1. A text book in Electrical Technology - B L Theraja – S. Chand and Company.
2. Performance and design of AC machines – M.G. Say, ELBS Edn.
3. Mechanical workshop practice, K.C. John, 2010, PHI Learning Pvt. Ltd.
4. Workshop Processes, Practices and Materials, Bruce J Black 2005, 3rd Edn., Editor Newnes [ISBN: 0750660732]
5. New Engineering Technology, Lawrence Smyth/Liam Hennessy, The Educational Company of Ireland [ISBN: 0861674480]

BPH 6L	L	T	P	C
Physics Lab-VI	**0**	**0**	**2**	**1**

List of Experiments

1. To study of 8085 Microprocessor training kit.
2. To perform addition of two 8 bit numbers; sum 8 bit.
3. To perform subtraction of two 8 bit numbers.
4. To perform the decimal addition of two 8 bit numbers, sum 16- bit.
5. To find the largest number from a given number of string.
6. To perform multiplication of 8 bit data; product should be 16 bit.
7. To interface ADC card to microprocessor & generate the digital output.

Chemistry

BCH-601	**L**	**P**	**T**	**C**
Organic Spectroscopy	**3**	**0**	**0**	**3**

Unit-I: Electromagnetic Spectrum

Absorption Spectra Ultraviolet (UV) absorption spectroscopy – absorption laws (Beer-Lambert law); molar absroptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome, Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. U.V. spectra of conjugated enes and enones.

Unit-II: Infrared (I.R.) spectroscopy

molecular vibrations, Hooke's law, selection rules, intensity and position of I.R. bands, measurement of I.R. spectrum, fingerprint region, characteristic absorptions of various functional groups and interpretation of I.R. spectra of simple organic compounds.

Unit – III: Nuclear magnetic resonance Spectroscopy

Proton magnetic resonance (^{1}H NMR) spectroscopy, nuclear shielding and deshielding, chemical shift and molecular structure, spin-spin splitting and coupling constants, areas of signals, interpretation of ^{1}H NMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1, 1, 2-tribromoethane, ethyl acetate, toluene and acetophenone, Problems pertaining to the structures elucidation of simple organic compounds using UV, IR and 1H NMR spectroscopic, techniques.

Recommended Books

1. Y.R. Sharma, *Elementary Organic Spectroscopy*, S. Chand, 2014.
2. Morrison, R.T. & Boyd, R.N. *Organic Chemistry*, Pearson, 2010.
3. Bahl, A. & Bahl, B.S. *Advanced Organic Chemistry*, S. Chand, 2010.

BCH-602	**L**	**P**	**T**	**C**
Pesticide Chemistry	**2**	**0**	**0**	**2**

General introduction to pesticides (natural and synthetic), benefits and adverse effects, changing concepts of pesticides, structure activity relationship.

Synthesis and technical manufacture and uses of representative pesticides in the following classes: Organochlorines (DDT, Gammexene,); Organophosphates (Malathion, Parathion); Carbamates (Carbofuran and carbaryl); Quinones (Chloranil), Anilides (Alachlor and Butachlor).

Practices

1 To calculate acidity/alkalinity in given sample of pesticide formulations as per BIS specifications.

2 Preparation of simple organophosphates, phosphonates and thiophosphates

Reference Book:

Cremlyn, R. *Pesticides. Preparation and Modes of Action*, John Wiley & Sons, New

York, 1978.

BCH 6L	L	T	P	C
Chemistry Lab-VI	**0**	**0**	**2**	**1**

List of Experiments

1. To determine the viscosity of a given liquid.
2. To determine the surface tension of supplied liquid.
3. To determine the solubility and solubility of a sparingly soluble electrolyte conducometrically.
4. To study the saponification of ethyl acetate condutometrically.
5. Estimation of ferrous and ferric by dichromate method.
6. Estimation of copper using thiosulphate.
7. Analysis of Cu as CuSCN and Ni as Ni (dimethylgloxime).
8. Estimation of hardness of water by EDTA.
9. Preparation of m-dinitrobenzene.
10. Preparation of p-nitroacetanilide.
11. Preparation of tris(thiourea)copper(I) sulphate dehydrate.
12. Preparation of potassium tris(oxalato)aluminate trihydrate
13. Preparation of potassium tris(oxalato)ferrate(III) trihydrate.
14. Preparation of hexaamminecobalt(III) chloride.

Mathematics

BMH-601	L	P	T	C
Analysis	**3**	**0**	**0**	**3**

Unit-I: Definition, existence and properties of Riemann integral of a bounded function, Darboux theorem, Condition of integrability, Riemann integrability for continuous functions, monotonic function and theorems on function with finite or infinite number discontinuity (without proof). The Riemann integral through Riemann sums, Equivalence of two definitions, Properties of

Riemann integral, Fundamental theorem of calculus, First Mean Value Theorems, Second Mean Value Theorems, Generalized Mean ValueTheorems.

Unit-II: Definition of improper integrals,Convergence of improper integrals, Test for convergence of improper integrals, Comparison test, Cauchy's test for convergence, Absolute convergence, Abel's Test, Dirichlet's Test, Beta and Gamma functions and their properties andrelations.

Unit-III: Pointwise and uniform convergence of sequences and series of functions, Cauchy's criterion for uniform convergence of sequence and series, Weierstrass M-test, Uniform convergence and continuity, Uniform convergence and differentiation, Uniform convergence and integration, Weierstrass ApproximationTheorem.

Unit-IV: Fourier Series, Fourier Series for even and odd functions, Half Range Series, Fourier Series on intervals other than $[-\pi,\pi]$. Power Series, Radius of Convergence, Cauchy's Hadamard Theorem, Uniform and Absolute convergence, Abel's Theorem (without proof), exponential and logarithmic functions.

Books Recommended:

1. R. G. Bartle and D. R. Sherbert, *Introduction to Real Analysis (*3^{RD}*Edition),* John Wiley and Sons (Asia) Pvt. Ltd., Singapore,2003.
2. S. C. Malik and Savita Arora, *Mathematicla Analysis*, New Age International (P) Ltd. Publishers,2009.
3. K. A. Ross, *Elementary Analysis: The Theory of Calculus, Under graduate Texts in Mathematics,* Springer (SIE), Indian reprint, 2004.
4. Sudhir R. Ghorpade and Balmohan V. Limaye, *A course in Calculus and Real Analysis, Undergraduate Text in Maths.,* Springer (SIE), Indian reprint2006.
5. T. M. Apostol, *Mathematical Analysis,* Addison-Wesley Series in Mathematics,1974.
6. Gerald G. Bilodeau, Paul R. Thie, G. E. Keough, *An Introduction to Analysis,* 2nd Ed., Jones & Bartlett, 2010.
7. A. Mattuck, *Introduction to Analysis*, Prentice Hall,1990.
8. Charles G. Denlinger, *Elements of Real Analysis*, Jones & Bartlett (Student Edition),2011.

RSP 102	**L**	**P**	**T**	**C**
Research Project	**3**	**0**	**0**	**3**