Jankidevi Bajaj College of Science, Wardha (Autonomous)

Syllabus for B. Sc. II (SEM-IV) w.e.f. 2018-19

Physics IV (BCSPHYT204)

Unit I : Crystallography [10h]

Solids: Amorphous and Crystalline Materials. Lattice translation vectors. Lattice with a Basis. Unit Cell. Miller Indices. Types of Lattices. Packing fraction, density calculation. Closed pack structures (fcc, hcp). Crystal structure of CsCl, NaCl, Diamond. Concept of reciprocal Lattice and its construction.

Unit II: X-rays and X-ray diffraction [10h]

Production of X-rays, X-ray spectra, Brehmstrahlung, Characteristic X-rays. **X-ray tubes & types**: Coolidge tube's construction and working. Application of X-rays (Imaging, diffraction, Auger effect). Diffraction of X-rays by crystals. Bragg's Law. Different methods of X-ray diffraction. Bragg's spectrometer. Diffraction in Reciprocal space. Bragg's law in reciprocal space.

Unit III: Molecular Physics [10h]

Quantization of vibrational and rotational energies, types of molecules based on moment of inertia, rigid diatomic molecules, Intensity distribution in rotational levels, Diatomic molecules as harmonic and anharmonic oscillator (concept only), Rotational-vibrational spectra, Born Oppenheimer approximation. Raman effect, Applications of Raman effect, Electronic spectra, Dissociation energy, Frank-Condon principle.

Unit IV: LASER [10h]

Spontaneous and stimulated emissions, Theory of laser action, three and four level Lasing action, Einstein's coefficients, components of LASER system, Characteristics of laser beam, Ruby LASER, He-Ne laser, Semiconductor lasers, CO_2 LASER, Nd: Yag LASER. Comparison of laser systems, Applications of lasers.

Unit V: Solid State Electronics [10h]

Light emitting diode, Photovoltaic cell, bipolar transistor- Construction and static characteristics, transistor as an amplifier, working in CB, CE and CC Modes, Graphical analysis of CE configuration, Current gains α and β, Relations between α and β, Load Line analysis of Transistors, DC Load line and Q-point,. Hybrid parameters, Equivalent circuit at low frequency in CE mode, Thermal Runaway, Heat sink, Stabilization, Stability factor, Bias stabilizing circuits.

Unit VI: Field Effect Transistor [10h]

Construction, working and principle of JFET, Characteristics of JFET, Parameters, JFET as an amplifier (input and output impedance, voltage gain), Advantage of JFET over BJT. **MOSFET**- Types of MOSFET, Construction and working of MOSFET, Characteristics of MOSFET, Special features and applications of MOSFET. Thin film transistors (TFT), single electron transistors (SET).

Laboratory-4

(BCSPHY P204)

List of Experiments: (Any 10) [40h]

1. To study the divergence of LASER beam.
2. To determine the wavelength of LASER beam using plane diffraction grating.
3. To construct SC,BCC, FCC structures and to find packing fraction and co-ordination number.
4. To determine lattice parameter 'a' of a unit cell of cubic crystal using X-ray diffraction pattern.
5. Identification of unknown wavelength /element from line emission spectra.
6. Study of vibrational spectra through infra red spectroscopy.
7. To determine Planck's constant by using LED.
8. Study of solar cell as photovoltaic cell.
9. To study the characteristics of transistor in C-E mode.
10. To study the characteristics of transistor in C-B mode.
11. To study the characteristics of Field Effect Transistor (FET).
12. To study the frequency response of single stage common emitter amplifier.
13. To study the frequency response of two stage RC coupled common emitter amplifier.
14. To determine the hybrid parameters of a transistor.
15. To determine the value of Boltzmann's constant using transistor.

Reference Books for Theory:

1. Introduction to Solid State Physics, Charles Kittel, 8th Ed., 2004, Wiley India Pvt. Ltd.
2. Elements of Solid State Physics, J.P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India
3. Material Science and Engineering, William Callister, Wiley.
4. Solid State Physics, M.A. Wahab, 2011, Narosa Publications.
5. Elements of Spectroscopy, by –Pragati Prakashan, Gupta, Kumar, Sharma.
6. Optics and Spectroscopy by-R. Murugeshan and Kiruthiga Sivaprakash, S Chand publication.
7. Advanced Molecular Physics by-Shriram and Sharma.
8. Electronics Principles by Malvino and Bates: Mcgraw Hill Education.
9. Electronic Devices and Circuit Theory by Boylsted : Pearson Publication.
10. Textbook of Electrical Technology by B.L. Thareja: S. Chand Publication.
11. Optics and Spectroscopy, by- R. Murugeshan , Kiruthign Sivaprakash.

12. Physics for Degree students for B. Sc. Second year, by- C. L. Arora, Dr. P. S. Hemne.
13. Solid State Physics and Electronics, by- R. K. Puri, and V. K. Babbar.
14. A text book of Optics, by- Dr. Subrahmanyam, Brijlal and M. N. Avadhanulu.

Reference Books for Practicals:

1. Advanced Practical Physics for students, B.L.Flint & H.T.Worsnop, 1971, Asia Publishing House.
2. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
3. Engineering Practical Physics, S.Panigrahi & B.Mallick,2015, Cengage Learning India Pvt. Ltd.
4. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
5. Physics through experiments, B Saraf et. al.,Vikas Publications 1987.
6. Advanced practical physics, Chauhan & Singh, Pragathi Publications 1ed.
7. Practical Physics, D. Chattopadhyaya et al, Central Publications.
8. An Advanced Course in Practical Physics , D Chattopadhyay, PC Rakshit, B Saha, New Central Book Agency (P) Limited, Kolkata, Sixth Revised Edition, 2002.
9. Practical Physics, D C Tayal 2002.