

Jankidevi Bajaj College of Science, Wardha (Autonomous)

Syllabus for B. Sc. III (SEM-V) w.e.f. 2019-20

Physics V (BCSPHYT305)

Unit I: Atomic Physics [10h]

Introduction (Revision of Bohr's model, Sommerfeld and Chadwick Model), Vector Atomic model, Stern-Gerlach experiment, spinning of electron, space quantization, selection rules, quantum numbers, L-S and J-J coupling, Pauli's exclusion principle, Hund's rule, Zeeman Effect: Normal Zeeman effect and Anomalous Zeeman effect.

Unit II: Relativity [10h]

Frame of references, Inertial and Non-Inertial frames, Galilean transformation equations, Galilean invariance and conservation laws, Michelson-Morley experiment and its negative result. Postulates of special theory of relativity, Lorentz transformation, Length contraction, Time dilation, velocity addition theorem, variation of mass with velocity, Mass Energy equivalence, Particle with zero rest mass.

Unit IV: Quantum Mechanics - I [10h]

Failure of Classical Physics, black body radiations, photoelectric effect, Einstein's explanation of photoelectric effect, Compton Effect, Wave Particle Duality, de Broglie's Hypothesis, Davisson and Germer experiment, concept of phase velocity and group velocity, wave packet, Heisenberg's Uncertainty Principle: Non-existence of electron inside the nucleus. Thought experiment: Gamma Ray Microscope.

Unit IV Nuclear Physics I [10h]

G.M counter, Linear Accelerator, Cyclotron, velocity selector, Bainbridge Mass Spectrograph, Nuclear reactions, Discovery of neutron, Packing fraction, Mass defect and binding energy, Nuclear fission, Liquid drop model, shell model of the nucleus, chain reaction, Nuclear reactors, Nuclear fusion, cosmic rays .

Unit V Nanomaterials and Characterizations [10h]

Nanomaterials- Introduction to Nanoscience and Nanotechnology, Difference between nanomaterials and bulk materials, reduction of dimensions, 3D, 2D, 1D & 0D materials, various morphologies of nanomaterials, Bottom up and top down approaches of synthesis, size dependent physical properties. Determination of size of nanocrystallites by Scherrer's formula, **Characterization Techniques-** Scanning Electron Microscope (SEM), Transmission Electron Microscopy (TEM), Polarimeter, Colorimeter and UV-vis. Spectrophotometry.

Unit VI: Statistical Physics [10h]

Introduction: Phase space, μ -space, Gamma space, probability distribution, thermodynamic probability, principle of a prior probability, Boltzmann's entropy relation, Macro and micro states, Maxwell-Boltzmann distribution law, its application to molecular speeds, limitations of M-B law, distinction between mean, RMS and most probable speed, Bose-Einstein Statistics (no derivation), Indistinguishability of particles and its consequences, Derivation of

Planck's radiation law, Wein's displacement law and Rayleigh's law, Estimation of temperature of sun. Fermi-Dirac distribution law (no derivation), Fermi energy, Fermi level, Fermi Temperature. Comparisons between M-B, B-E and F-D statistics.

Laboratory-5 (BSCPHYP305)

List of Experiments (Any 10) [40h]

1. To determine the Rydberg's constant by hydrogen spectra.
2. To study the absorption spectra of iodine vapours.
3. To determine the e/m ratio by Thomson method.
4. To determine e/m by Helical method.
5. To determine the Planck's constant by using photocell/solar cell.
6. To determine the Planck's constant by using LED.
7. To study the random decay of nuclear disintegration and determination of decay constant using one colored face dices.
8. To study the statistical distribution from the given data and to find most probable average and RMS value.
9. To draw the plateau curve of a Geiger Mueller counter.
10. To determine the size of nanocrystals by using Scherrer formula.
11. To determine the unknown concentration of KMnO_4 solution using colorimeter.
12. To determine the electric charge of an electron by Millikan's oil drop method.
13. To determine the electronic charge and work function of a cathode material using photocell.
14. To study inverse square law using static characteristics of photocell.
15. To determine the specific rotation of a given optically active compound glucose using half shade polarimeter.
16. To analyze the image of SEM/TEM of nanoparticles.
17. To calculate the optical band gap of nanomaterial by UV visible spectrum.

Reference Books for Theory:

1. Atomic Physics by J. B. Rajam.
2. Nuclear Physics by S.N. Ghoshal (S. Chand).
3. Introductory Nuclear Physics by Kenneth Krene(John Wiley and sons)
4. Concepts of Modern Physics: Arthur Beiser (Tata Mc Graw Hill)
5. Physics for Degree Students BSc-III by C.L. Arora and P.S. Hemne.(S. Chand)
6. Elements of Special Theory of Relativity by M.K. Bagde and S.P. Singh (S. Chand)
7. Introduction to theory of Relativity by P.G. Bergmann
8. Introduction to Special Theory of Relativity by Shrivastava.
9. Material Science and Engineering, William Callister, Wiley.
10. Fundamentals of statistical and thermal physics - by F. Reif.
11. Fundamental of Statistical Mechanics - By B.B. Laud.
12. Statistical Physics: Berkeley Physics Course Volume-5 by F. Reif Tata McGraw-Hill Company Ltd, 2008).

13. Introduction to Quantum Mechanics, David J. Griffith, 2nd Ed. 2005, Pearson Education.
14. Quantum Mechanics, G. Aruldas, 2nd Edn. 2002, PHI Learning of India.
15. Quantum Mechanics by Chatwal and Anand (Himalaya Publications)
16. Introduction to Nanotechnology by Charles Poole
17. [Nanotechnology: Principles and Practices by Sulabha K. Kulkarni](#)

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 1st Ed.
7. Practical Physics, D. Chattopadhyaya *et al.*, Central Publications.
8. An Advanced Course in Practical Physics , D Chattopadhyay, P C Rakshit, B Saha, New Central Book Agency (P) Limited, Kolkata, Sixth Revised Edition, 2002
9. Practical Physics, D C Tayal, 2002.