UNIVERSITY OF MADRAS
B.Sc. DEGREE COURSE IN PHYSICS
SYLLABUS WITH EFFECT FROM 2020-2021

BPS-CSC14

CORE-XIV: ATOMIC PHYSICS & LASERS
(Common to B.Sc.Physics with Computer Applications-IV Sem.)

Lecture: 60 Hours Tutorial: 15 Hours Credits:4

Course Objectives:

To study the transition from particle to wave nature
To study the atomic structure and spectral series with electric and magnetic fields
To inculcate in depth knowledge in Lasers

Learning Outcomes:

On completion of the course the students will be able to

- Use Photo electric effect appropriately
- Analyze the atomic structure and associated coupling schemes
- Understand the splitting of spectral lines due to electric and magnetic fields
- Be familiar with X rays and its applications
- Distinguish different types of Lasers

UNIT I: PHOTO-ELECTRIC EFFECT (10 Hours)

Richardson and Compton experiment - Laws of Photoelectric emission - Einstein Photo Electric Equation - Millikan's Experiment - Verification of Photoelectric equation -Photo electric cells - Photo emissive cells - Photovoltaic cell - Photo conducting cell - Photomultiplier.

UNIT II: ATOMIC STRUCTURE (10 Hours)

Bohr and Sommerfeld atom models - Vector atom model - Pauli's exclusion principle - Explanation of periodic table - various quantum numbers - angular momentum and magnetic moment - coupling schemes - LS and JJ coupling - special quantisation - Bohr magnetron – Stern and Gerlach experiments.

UNIT III: FINE STRUCTURE OF SPECTRAL LINES (15 Hours)

Excitation and Ionization Potential – Frank and Hertz's experiment - Davis and Goucher's method-Spectral terms and notions - selection rules - intensity rule and interval rule -fine structure of sodium D_2 lines - Alkali Spectra - Fine Structure of Alkali Spectra - Spectrum of Helium - Zeeman effect - Larmor's theorem - Debye's explanation of normal Zeeman effect- Anomalous Zeeman effect - theoretical explanation- Lande's `g' factor and explanation of splitting of D_1 and D_2 lines of sodium -Paschen-Back effect - Stark effect (qualitative study only).

UNIT IV: X-RAYS **(10 Hours)**

X-rays: Bragg's law - X-ray spectroscopy - characteristic X-ray spectra - continuous X-ray spectra - X-ray absorption and fluorescence - Moseley's law - uses of X-rays-Compton effect - Experimental verification of Compton effect.

UNIT V: Lasers **(15 Hours)**

Basic principles of laser – Einstein Coefficients – Condition for light amplification - Population inversion - Threshold condition – Optical resonators (Qualitative only) -Types of Lasers –Solid State lasers - Ruby and Nd-YAG Laser - Gas lasers - He-Ne and Co_2 Lasers- Construction and Working- Semiconductor lasers - (Homojunction & Heterojunction)-Industrial and Medical Applications.

Books for Study:

1. Concepts of Modern physics, A Beiser, Tata McGraw Hill, New Delhi (1997).
2. Modern Physics, R Murugeshan, S Chand & Co., New Delhi (2004).
3. Atomic and Nuclear Physics, N Subramanian and BrijLal, S Chand & Co. (2000).
4. Atomic Physics,J .B.Rajam,S.Chand& Co, 20th Edition, New Delhi(2004)
5. Laser theory and applications ,K. Thyagarajan and AjoyGhatak,Cambridge University Press, (1999).
6. An Introduction to laser, Theory and Applications ,M. N.Avadhanulu, S. Chand and Co., New Delhi (2001).

Books for Reference:

1. Fundamentals of Physics, D Halliday, R Resnick and J Walker,6th edition, Wiley NY (2001).
2. Physics for Engineering, P.K. Palanisamy, Scitech PublishingPvt. Ltd,Chennai.
3. Lasers and non-linear optics, B. B. Laud, New Age International (P) Ltd., IIIEdn., (2011).

https://youtu.be/Aoi4j8es4gQ

https://www.digimat.in/nptel/courses/video/104104085/L06.html