337C5A

COURSE	**FIFTH SEMESTER – CORE COURSE – V**
COURSETITLE	**ATOMIC PHYSICS AND LASERS**
CREDITS	**5**
COURSE OBJECTIVES	To study about electric charges, their properties through experiments; To gain knowledge on photoelectric effect; To solve problems based on Einstein's photoelectric equation; To make students understand the development of atom models, quantum numbers, coupling schemes and analysis of magnetic moments of an electrons; To gain knowledge on excitation and ionization potentials, splitting of spectral lines in magnetic and electric fields; To understand the principle, production and applications of lasers.

UNITS	COURSE DETAILS
UNIT-I	**THE ELECTRON AND POSITIVE RAYS:** e/m of electronby Dunnington's method –charge of electron by Millikan's oil drop method – properties of positive rays –e/m of positive rays by Thomson's parabola method (problems calculation of e/m ratio of positive rays)–mass spectrographs and uses– Bainbridge and Dempster's mass spectrographs
UNIT-II	**PHOTOELECTRIC EFFECT:** Photoelectric Emission – Leonard's Experiment – Richardson and Compton Experiment –Laws of Photoelectric Emission – Einstein's Photoelectric Equation (Problems using Einstein's Photoelectric Equation) –Experimental Verification by Millikan's Method – Photoelectric Cell– Photo Emissive Cell –Photovoltaic Cell – Photo Conducting Cell – Applications of Photoelectric Cells –Photomultiplier.
UNIT-III	**ATOMIC STRUCTURE:** Sommerfield's relativistic atom model –vector atom model –various quantum numbers – L-S and J-J coupling – Pauli's exclusion principle – magnetic dipole moment of an electron due to orbital and spin motion – Bohr magneton - Stern and Gerlach experiment – Lande 'g' factor.
UNIT-IV	**SPLITTING OF SPECTRAL LINES:** Excitation, Ionisation and Critical Potentials – Davis and Goucher's Method – Optical Spectra – Spectral Notation and Selection Rules – Fine Structure of Sodium D-Line – Zeeman Effect – Experimental Arrangement and Classical Theory of Normal Zeeman Effect – Larmor's Theorem –Quantum Theory of Normal Zeeman Effect –Anomalous Zeeman Effect –Explanation of Splitting of D1 And D2lines of Sodium – Paschen Back Effect - Stark Effect (Qualitative Only).

UNIT-V	**LASERS:** General Principles of Lasers – Properties of Lasers Action – Spontaneous and Stimulated Emission – Population Inversion – Optical Pumping – He-Ne Laser (Principle and Working) – Semiconductor Laser –Laser Applications–Holography.
TEXT BOOKS	1. R. Murugesan, Modern Physics, S. Chand & Co. (All units) (Units I&II-Problems) 2. Brijlal& N. Subrahmanyam, Atomic & Nuclear Physics, S. Chand & Co. (All units) 3. J. B. Rajam, Modern Physics, S. Chand & Co. 4. Sehgal&Chopra, Modern Physics, Sultan Chand, New Delhi 5. Avadhahnulu, An Introduction to Lasers - Theory and Applications, M.N., S.Chand& Co., New Delhi, 2001.
REFERENCE BOOKS	1. Perspective of Modern Physics, Arthur Beiser, McGraw Hill. 2. Modern Physics, S. Ramamoorthy, National Publishing & Co. 3. Laser and Non-Linear Optics by B.B.Laud, Wiley Easter Ltd.,New York,1985.
WEBLINKS	1. http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html 2. https://makingphysicsfun.files.wordpress.com/2015/01/photoelect ric-effect.pptx 3. https://www.khanacademy.org/science/physics/quantum - physics/in-in-nuclei/v/types-of-decay 4. https://www.khanacademy.org/science/in-in-class-12th-physics-india/nuclei

UNIVERSITY OF MADRAS

B.Sc. DEGREE PROGRAMME IN PHYSICS

SYLLABUS WITH EFFECT FROM 2023-2024

COURSE OUTCOMES:

At the end of the course,the student will be able to:

COURSE OUTCOMES	**CO1**	**List**the properties of electrons and positive rays, **define**specific charge of positive rays, **know** different mass spectrographs.
	CO2	**Outline**photoelectric effect and the terms related to it, **State**laws of photoelectric emission,Explainexperiments and applications of photo electric effect, Solve problems based on photoelectric equation.
	CO3	**Explain different atom models,** Describe**different quantum numbers and different coupling schemes.**
	CO4	**Differentiate between** excitation and ionization potentials, **Explain** Davis and Goucher's experiment,**Apply**selection rule,**Analyse**Paschen-Back effect,**Compare** Zeeman and Stark effect.
	CO5	**Understand the condition for production of laser, Appreciate various** properties and applications of lasers.

MAPPING WITH PROGRAM OUT COMES:

Map course outcomes**(CO)** for each course with program outcomes**(PO)** inthe3- point scale of STRONG(**S**), MEDIUM(**M**) and LOW(**L**).

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	S	S	S	S	M	S	M
CO2	S	S	M	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	M	S	S	S
CO4	M	S	S	S	S	M	S	M	M	M
CO5	S	M	S	S	M	S	S	M	M	S