Sacred Heart College (Autonomous), Tirupattur District

1.2.1 List of New Courses

B.Sc. Physics

Semester	Paper	Title of the Paper	Hours/ Week	Credits	Marks	
					CA	SEM
I	Main Core	Mechanics	3	4	30	70
	Main Core	Properties of matter	3	4	30	70
	Allied	Allied Mathematics - I	6	4	30	70
	Main Core Practicals	Physics Main Practicals – I	4	2	40	60
	Language	Tamil	5	3		
	Language	General English	5	3		
		Communicative English	-	1		
	Life Education	Personal Skills	2	1		
		Christian Religion–1 / Value Education-1	2	1		
TOTAL			30	23		

Semester	Paper	Title of the Paper	Hours/ Week	Credits	Marks	
					CA	SEM
II	Main Core	Heat and Thermodynamics	3	4	30	70
	Main Core	Sound	3	4	30	70
	Main Core Practicals	Physics Main Practicals – I	4	2	40	60

	Allied	Allied Mathematics – II	**6**	**4**	**30**	**70**
	Language	Tamil	**5**	**3**		
	Language	General English	**5**	**3**		
		Communicative English		**1**		
	Life Education	Social Skills	**2**	**1**		
		Christian Religion-2/Value Education-2	**2**	**1**		
TOTAL			**30**	**23**		

Semester	Paper	Title of the Paper	Hours/ Week	Credits	Marks	
					CA	SEM
III	Main Core	Electromagnetism	**3**	**4**	**30**	**70**
	Main Core	Optics	**3**	**4**	**30**	**70**
	Main Core Practicals	Physics Main Practicals – II	**4**	**2**	**40**	**60**
	Allied	Allied Chemistry -I	**6**	**4**	**30**	**70**
	Language	Tamil	**5**	**3**		
	Language	General English	**5**	**3**		
	Life Education	Employability Skills –1	**2**	**1**		
		Environmental Science	**2**	**1**		
	Extra credit Course	Special Project- I	**-**	**2#**		**100**
TOTAL			**30**	**22+2#**		

Semester	Paper	Title of the Paper	Hours/ Week	Credits	Marks	
					CA	SEM
IV	Main Core	Atomic Physics	**3**	**4**	**30**	**70**
	Main Core	Spectroscopy	**3**	**4**	**30**	**70**
	Main Core Practicals	Physics Main Practicals – II	**4**	**2**	**40**	**60**
	Allied	Allied Chemistry –II	**6**	**4**	**30**	**70**
	Language	Tamil	**5**	**3**		
	Language	General English	**5**	**3**		

	Life Education	Employability Skills –2	**2**	**1**		
		Human Rights	**2**	**1**		
	Extra credit Course	Special Project II (Repair and Maintenance of Lab Equipments)	**-**	**2#**		**100**
	Extension	DEEDS	**-**	**2**		
		SHELTERS	**-**	**2**		
TOTAL			**30**	**26+2#**		

Semester	**Paper**	**Title of the Paper**	**Hours/ Week**	**Credits**	**Marks**	
					CA	**SEM**
V	Main Core	Classical mechanics and Statistical physics	**4**	**4**	**30**	**70**
	Main Core	Basic Electronics	**4**	**4**	**30**	**70**
	Main Core	Solid State Physics	**4**	**4**	**30**	**70**
	Main Core	Mathematical Physics	**4**	**4**	**30**	**70**
	Main Core	Physics Main Practicals – III (General experiments)	**3**	**3**	**40**	**60**
	Main Core	Physics Main Practicals – IV (Electronic experiments)	**3**	**3**	**40**	**60**
	Subject Elective	1. Crystal Growth & Nano Technology 2. Electronic communication systems 3. Renewable Energy and Energy Harvesting	**3**	**2**	**30**	**70**
	Subject Elective	1. Applied optics 2. 8085 Microprocessor and its applications 3. Medical Physics	**3**	**2**	**30**	**70**
	Self Study Paper	Astrophysics	**–**	**1***	**-**	**100**
	Non Major Elective	Repair and maintenance of household appliances	**2**	**1**	**30**	**70**
TOTAL			**30**	**27+1***		

Semester	**Paper**	**Title of the Paper**	**Hours/ Week**	**Credits**	**Marks**	
					CA	**SEM**
VI	Main Core	Applied Electronics	**5**	**5**	**30**	**70**
	Main Core	Nuclear Physics	**5**	**5**	**30**	**70**
	Main Core	Quantum Mechanics and Relativity	**4**	**4**	**30**	**70**
	Main Core	Physics Main Practicals – III (General experiments)	**2**	**2**	**40**	**60**

	Main Core	Physics Main Practicals – IV (Electronic experiments)	**2**	**2**	**40**	**60**
	Subject skill	Electrical circuits and Networks	**5**	**4**	**40**	**60**
	Subject skill	Basic Instrumentation	**5**	**4**	**40**	**60**
	Self Study Paper	Physics Revisited	**–**	**1***	**-**	**100**
	Non Major Elective	Physics in everyday life	**2**	**1**	**30**	**70**
Total			**30**	**27+1***		

Sacred Heart College (Autonomous), Tirupattur District

1.2.1 List of New Courses

Department: B.SC. Physics

Electromagnetism

Semester : III **Hours / Week : 3**

Course code : **Credits : 4**

S. No	Course Code	Course Name
1.	P312	Electromagnetism
2.	P313	Optics
3.	P412	Atomic physics
4.	P413	Spectroscopy

Objectives

- To introduce the students to the basic concepts of Electrostatics and Electricity
- To explain the principle and working of Potentiometer and Carey Foster's Bridge
- To provide an overview of the fundamental principles of Coulomb's law, Biot-Savart law and magneto statics.
- To Expose the students to Maxwell's equations

Learning outcomes

On the completion of this course, students will be able to:

- Explain and differentiate between electric field and electric potential
- Illustrate the coulomb's law
- Describe electromagnetic induction and related concepts and make calculations using faraday's laws.
- Describe the properties of Dia, Para and Ferro magnetic materials and identify the form of magnetism possessed by a material.

Unit I: Electrostatics and Current electricity

Coulomb's law – permittivity – relative permittivity – electric intensity – electric induction – electric potential – electric current – relation between electric field and electric potential in vector form – Gauss law – Carey foster's bridge – theory – measurement of resistance and

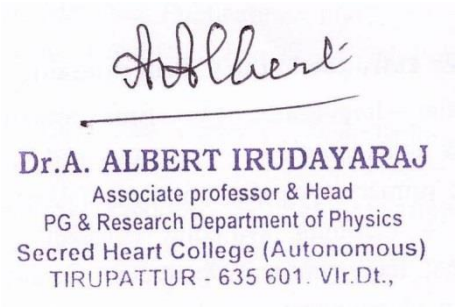
temperature coefficient of resistance of a coil – Potentiometer – principle – resistance of potentiometer wire –measurement of emf of a thermocouple.

Unit II: Magnetic effect of current

Ampere's circuital law – curl of magnetic field - Biot-Savart law – magnetic induction at a point on the axis of a circular coil carrying current –Force on a current carrying conductor placed in a magnetic field – theory of moving coil ballistic galvanometer – damping correction – figure of merit of BG – absolute capacitance of a capacitor – growth and decay of C-R circuit.

Unit – III: Magnetism

Magnetic properties of materials: Magnetic intensity, permeability, magnetic susceptibility – Curie temperature – Magnetic materials: dia, para, ferro, antiferro, ferri – Langevin's theory of dia magnetism and para magnetism – general applications of magnetic materials.



Unit – IV: Electromagnetic Induction

Faraday's laws of electromagnetic induction (vector form) – Lenz's law – equation of continuity of current – displacement current – self induction – co-efficient of self induction – determination of self inductance by Anderson's bridge method – mutual induction – co efficient of mutual induction – absolute mutual inductance by B.G.

Unit – V: Maxwell`s equations and Electromagnetic wave propagation

Maxwell's equations – significance – Maxwell's equation in free space, dielectric and conducting medium – Poynting theorem – energy density in electromagnetic field – Poynting vector –electromagnetic wave propagation through vacuum and dielectric medium.

Books for study

1. R. Murugeshan, Electricity and Magnetism, S. Chand & co, New Delhi, 2006
2. M. Narayanamurthy., N. Nagarathanam., Electricity & Magnetism, Meerut, National publishing Co, 2001

Books for reference

1. K. K. Tewari, Electricity and Magnetism, Magnetism, S Chand & co., New Delhi, 2001.
2. Brijlal and N. Subramanyan, Electricity and Magnetism, Agra., Ratan & Prakash,1995**.**
3. D. L. Shegal, K. L. Chopra, N. K. Sehgal, Electricity and Magnetism, Sultan Chand & Sons., New Delhi, 2006.

4. B. D. Dugal and C. L. Chopra. Fundamentals of Electricity and Magnetism, Shobanlal Nagin Chand, New Delhi, 2000.
5. Edward Purcell, Electricity and Magnetism, Cambridge University press, United Kingdom, 2011.
6. Dugald C. Jackson, An elementary book on Electricity, Magnetism and their Applications, The Macmillian company, New York, 1994.

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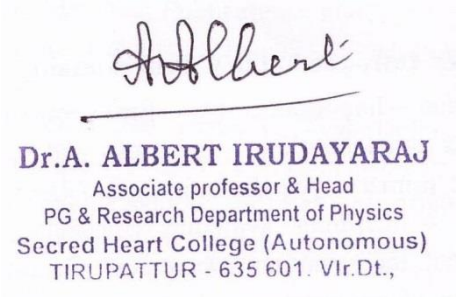
2. www.learnnext.com/nextgurukul/wiki/concept/CBSE/X/Science/Magnetic–Effects–of–Electric–Current.htm
3. http://www–spof.gsfc.nasa.gov/Education/Imagnet.html
4. http://www.electronics–tutorials.ws/electromagnetism/electromagnetic–induction.html
5. http://www.maxwells–equations.com/



Optics

Semester : III **Hours / week : 3**

Course code : **Credits : 4**

Objectives

- Providing a broad overview of Aberration in lenses, Achromatic doublets, interference, diffraction and polarization
- Exposing the students to the principles and applications of LASER and MASER

Learning Outcomes

On completion of this course, students will be able to

- Understand the meaning of spherical aberration and Chromatic aberration and the methods of minimizing them.
- Explain the concepts of Diffraction, Interference and Polarization.
- Describe the fundamental operational principles of major types of LASER and MASER.

Unit – I: Geometrical Optics

Dispersion produced by a prism – angular dispersion – dispersive power – combination of prisms to produce (i) Dispersion without deviation (ii) deviation without dispersion – direct vision spectroscope.

Aberration in lenses – spherical aberration – methods to minimize spherical aberration – chromatic aberration – achromatic combination of two lenses (i) in contact (ii) out of contact.

Unit– II: Interference

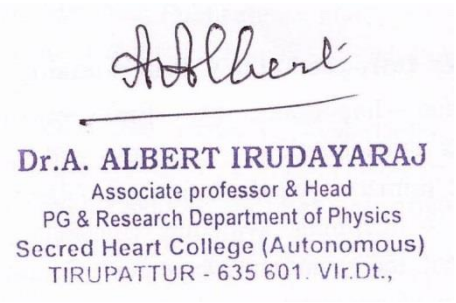
Interference: Amplitude and wave front – Young's double slit experiment – phase change on reflection: Stokes' treatment – Interference in thin films – condition for maxima and minima – Air wedge – thickness of thin wire – Newton's Rings: measurement of wavelength and refractive index – Michelson's interferometer **–** determination of wavelength – wavelength difference.

Unit – III: Diffraction

Fraunhofer diffraction: Single slit– double slit – Fresnel diffraction: Half – period zones – zone plate – Fresnel diffraction pattern of a straight edge, a slit and a wire using half –period zone analysis – plane transmission grating – theory – determination of wavelength.

Unit – IV: Polarization

Transverse nature of light waves – double refraction – optical axis – plane polarized light – production and analysis by Nicol prism – circular and elliptical polarization – optical activity – polaroids – applications.



Unit – V: LASER and MASER

Laser: characteristics – stimulated absorption – spontaneous emission and stimulated emission –population inversion – pumping – types – principle of Laser action – condition for Laser action – CO_2 Laser – semiconductor Laser – applications of Laser.

Maser – principle of Maser action – Ammonia gas Maser.

Books for study

1. Brij Lal and N. Subramanyam, A text book of Optics, Niraj Prakahshan, New Delhi, 2003.
2. R. Murugesan, Modern Physics, S. Chand & Co. Ltd., New Delhi, 2001.
3. C .L. Arora,Optics , S. Chand & Co. Ltd., New Delhi, 1999.
4. S. Shanmugam, Nanotechnology, MJP Publishers, Chennai, 2010.

Books for reference

1. R. Murugesan., Optics and spectroscopy, S. Chand & company Ltd., New Delhi, 2003.
2. N. Subrahmanyam and Brijlal, Atomic Physics, S.Chand and Company Ltd., New Delhi, 2007.
3. S. N. Ghoshal, Atomic and Nuclear Physics, S.Chand and Company Ltd., New Delhi, 2004.
4. K. K. Chattopadhyay, A. N. Banerjee, Introduction to Nanoscience and Technology, PHI learning Pvt. Ltd, New Delhi, 2009.
5. Charles. P. Poole, Frank. J. Owens, Introduction to nanotechnology, A John Wiley & Sons publications, New Jerssey, 2003.

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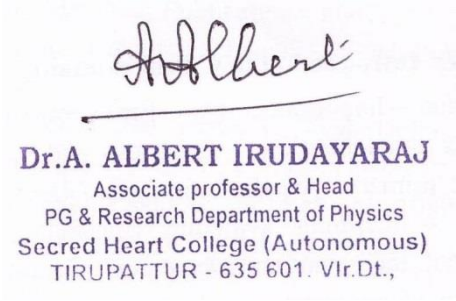
2. http://hyperphysics.phy–astr.gsu.edu/hbase/phyopt/fresnelcon.html
3. www.microscopyu.com/techniques/polarized–light/introduction–to–polarized–light
4. http://hyperphysics.phy–astr.gsu.edu/hbase/optmod/fibopt.html



Atomic Physics

Semester : IV **Hours/week : 3**
Course Code : **Credits : 4**

Objectives

- To make the students to understand the concepts of positive rays and X- rays and their applications.
- To study atom models and their importance.
- To acquire the knowledge about magneto optical properties of spectrum and photo electric effect.

Learning Outcomes

On successful completion of this course, students will be able to

- Describe how positive rays and X-rays are formed.
- Discuss the production of x-rays as the inverse of the photo electric effect.
- Describe the origin of sub-shells, shells and multiplets for atoms with two or more electrons.
- Carry out experimental and theoretical studies on atoms, with focus on the structure and dynamics of atoms.

Unit - I: Positive rays

Discovery – properties – positive ray analysis: Thomson's Parabola method – detection of isotopes - Dempster's mass spectrographs - Dunnington's mass spectrograph – uses of mass spectrograph.

Unit - II: Photo-electric effect

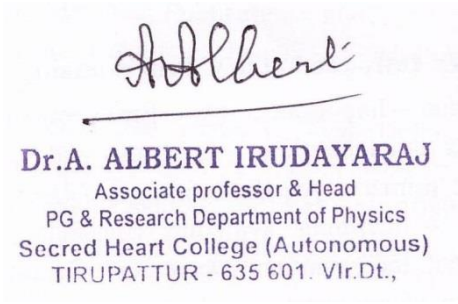
Drawbacks of classical wave theory – photon – Photo-electric effect – laws of photoelectric emission – Richardson and Compton experiment – relation between photoelectric current and retarding potential – relation between velocity of photoelectrons and frequency of light – Einstein's photoelectric equation.

Unit - III: Structure of the atom

Vector atom model – spatial quantization and electron spin – quantum numbers associated with electron – Pauli's exclusion principle – spin-orbit coupling in atoms: LS and jj couplings – periodic classification of elements.

Unit - IV: Magneto optical properties of spectrum

Magnetic dipole – moment due to orbital motion of the electron – magnetic dipole moment due to spin – Stern and Gerlach experiment – normal and anomalous Zeeman effect – experiment – Larmor's theorem – Paschen-Back effect.



Unit - V: X-ray spectra

X-Rays: properties – diffraction of X-rays – Bragg's law – measurement of wavelength of X-rays – Bragg's X-ray spectrometer – Moseley's law – importance – types of X-ray spectra – continuous and characteristic X-ray spectra – Compton effect – Compton wavelength – experimental verification.

Books for study

1. R. Murugeshan, Modern Physics, S. Chand and Company Ltd., Ram Nagar, New Delhi, 2009.
2. N. Subrahmanyam and Brijlal, Atomic Physics, S. Chand and Company Ltd., New Delhi, 2010.

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1. S. N. Ghoshal, Atomic and Nuclear Physics, Volume–I, S. Chand and Company Ltd., Ram Nagar, New Delhi, 1996.
2. Arthur Beiser, Concepts of Physics, Tata Mcgraw – Hill – Sixth Edition, 2003.
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3. http://www.citycollegiate.com/xii_chpxiv1.htm
4. http://www.readorrefer.in/article/Photoelectric-effect-Dual-Nature-of-Radiation_2942/
5. http://www.physics-assignment.com/vector-atom-model
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9. http://www.physics-assignment.com/zeeman-effect
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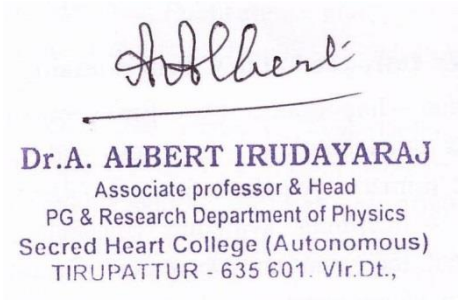
14. http://www.readorrefer.in/article/Moseley-s-law-and-Applications-of-Moseley-s-law_2936/
15. http://nptel.ac.in/courses/122101002/downloads/lec-25.pdf



Spectroscopy

Semester : IV **Hours/week : 3**

Course code : **Credits : 4**

Objectives:

- To provide a knowledge of interaction of electromagnetic radiation with atoms and molecules.
- To expose to the various spectroscopic techniques and their usage.

Learning outcome:

- Students will understand the fundamentals of electromagnetic radiations
- Students will realize the importance of spectroscopy and spectrometers

UNIT- I: Principles of Spectroscopy

Eelectromagnetic spectrum – interaction of electromagnetic radiation with matter – scattering, dispersion and transmission of radiation – Born Oppenheimer approximation – vibrational, rotational and electronic energy levels – types of molecular spectra – selection rules – characteristic features for absorption and emission – band width – factors contributing to band width.

UNIT-II: Electronic Spectroscopy

Fundamental laws of absorption- Lamberts Bouguer's law, Beer's law – deviations from Beer's law – absorptivity and absorbance – absorbance and transmission spectrum – origin of visible and UV spectra – Frank-Condon principle – transition probability – UV-Visible spectrophotometer- photoelectric colorimeter

UNIT – III: Vibrational Spectroscopy

Vibrational spectroscopy of diatomic and simple molecules: harmonic Oscillator – anharmonic oscillator – normal modes of vibration of CO_2 and H_2O molecules – Experimental setup of IR spectrometer.

Raman Effect – classical theory of Raman scattering – quantum theory of Raman scattering (no derivation) – experimental setup of Raman spectrometer – comparison of IR and Raman spectroscopy

UNIT – IV: Rotational Spectroscopy

Pure rotational spectra of diatomic molecules, polyatomic molecules, linear molecules, symmetric top molecules – microwave spectrometer - Stark effect - applications to chemical analysis.

Dr.A. ALBERT IRUDAYARAJ
Associate professor & Head
PG & Research Department of Physics
Secred Heart College (Autonomous)
TIRUPATTUR - 635 601. Vlr.Dt.,

UNIT-V: Resonance Spectroscopy

Principle of NMR – chemical shift – shielding and deshielding effects – factors affecting chemical shift – experimental methods: Single coil and double coil – Applications.
Principle of ESR – instrumentation – applications.

Books for study

1. C. N. Banwell, E. M. McCash, Fundamentals of Molecular Spectroscopy, 5th Edition, Tata McGraw-Hill Publications, New Delhi, 2002.
2. G. Aruldas, Molecular Structure and Spectroscopy, 2nd Edition, Prentice – Hall of India Pvt.Ltd. New Delhi, 2007.
3. D. N. Satyanarayana, Vibrational Spectroscopy and Applications, New Age International Publications, New Delhi, 2004.

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2. Towne and Schawlow, Microwave Spectroscopy, McGraw Hill, New Delhi, 1995.
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Dr.A. ALBERT IRUDAYARAJ
Associate professor & Head
PG & Research Department of Physics
Secred Heart College (Autonomous)
TIRUPATTUR - 635 601. Vlr.Dt.,