SACRED HEART COLLEGE (AUTONOMOUS)

Tirupattur – 635 601, Tamil Nadu, S.India

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Ready for
Every Good Work

A Don Bosco Institution of Higher Education, Founded in 1951 * Affiliated to Thiruvalluvar University, Vellore * Autonomous since 1987

Accredited by NAAC (4th Cycle – under RAF) with CGPA of 3.31 / 4 at 'A+' Grade

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

Course Code	Course Name
P536	Solid State Physics
P537	Mathematical Physics
P538A	Crystal growth and Nano Technology
P538C	Renewable Energy and Energy Harvesting
P539A	Applied Optics
P539B	8085 Microprocessor and its applications
P539C	Medical Physics
P540X	Astrophysics
NPH503	Repair and maintenance of household appliances
P633	Quantum Mechanics and Relativity
P634	Electrical circuits and Networks (theory& practical's)
P635	Basic Instrumentation(theory & practical's)
P636X	Physics Revisited
NPH603	Physics in everyday life

SYLLABUS

Solid State Physics

Semester : V Hours/week : 4

Course Code : Credits : 4

Objectives

To provide an understanding of the basics of crystal physics, metals, semiconductors, magnetic materials, superconductors and dielectric materials.

To familiarise with the various theoretical models to study the properties of magnetic materials, superconductors.

Learning outcomes

Students will learn and understand the crystal structure and Bragg's law.

Understand the concept of band theory and classification of materials.

Students able to learn about the properties of superconductors and magnetic materials.

Unit–I: Crystal Structure

Solids – amorphous and crystalline materials – lattice translation vectors – unit cell – primitive cell – reciprocal lattice – Miller indices – packing factor – SC – BCC – FCC structures – diffraction of X-rays by crystals – Coolidge tube – Bragg's law.

Unit–II: Elementary Lattice Dynamics

Lattice vibrations and phonons – acoustical and optical phonons – qualitative description of the phonon spectrum in solids – specific heat capacity – Dulong and Pettit's law – Einstein and Debye theories of specific heat of solids.

Unit–III: Magnetic Properties of Matter

Dia – para – ferromagnetic materials – quantum mechanical treatment of paramagnetism – Curie's law – Weiss's theory of ferromagnetism – ferromagnetic domains – discussion of B-H curve – ferrites and their applications.

Unit–IV: Dielectric Properties

Polarization – dielectric constant – local electric field at an atom – depolarization field – electric susceptibility – polarizability – Clausius-Mosotti equation – frequency and temperature dependence of polarization – classical theory of electric polarizability – Langevin-Debye equation – complex dielectric constant.

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Unit–V: Elementary band theory and Superconductivity

Elementary band theory: Conductors – semiconductors and insulators – conductivity of semiconductors – mobility – Hall Effect – Hall coefficient.

Superconductivity: Experimental results – critical temperature – critical magnetic field – isotope effect – Meissner effect – type I and type II superconductors – BCS theory (Qualitative treatment) – London's equations – applications.

Books for study

Charles Kittel, Introduction to Solid State Physics, Wiley & Sons, New York, 1996.

A. J. Dekker, Solid State Physics, McMillan & Co, New Delhi, 2002.

S.O. Pillai, Solid State Physics, New age international publishers, New Delhi, 2003.

Books for reference

J.P. Srivastava, Elements of Solid State Physics, 2nd edition, Prentice–Hall, India, 2006.

Leonid V. Azaroff, Introduction to Solids, Tata Mc–Graw Hill, 2004.

Neil W. Ashcroft, N. David Mermin, Solid State Physics, Cengage Learning, 1976.

Rita John, Solid State Physics, McGraw Hill, 2014.

H. Ibach, H Luth, Solid State Physics, Springer, 2009.

M. Ali Omar, Elementary Solid State Physics, Pearson, India, 1999.

M.A. Wahab, Solid State Physics, Narosa Publications, 2011.

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http://ocw.mit.edu/courses/materials-science-and-engineering/3-091sc-introduction-to-solid-state-chemistry-fall-2010/syllabus/MIT3_091SCF09_aln03.pdf

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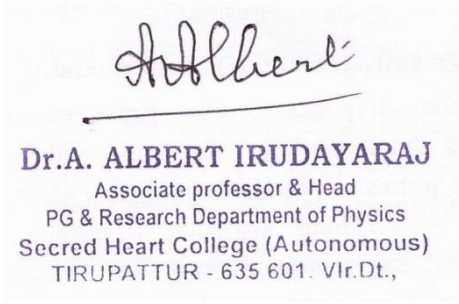


Mathematical physics

Semester :V Hours/Week : 4

Course Code : Credits : 4

Objectives

To develop sensitivity towards various mathematical techniques in the minds of students which are useful in physics and engineering applications.

To impart the basic concepts of mathematics and to make the students to realize the usage of mathematics in physics.

Learning Outcomes

Students will understand the concept of vectors and will be able to resolve a vector in to components.

Students will understand that the importance and application of Dirac delta function.

Students will understand the primary use of Green's function to solve non–homogeneous boundary value problems.

Students will understand the importance and applications of Fourier series.

Students will acquire the ability to solve higher order partial differential equations by the method of separation of variables.

Unit – I: Vectors – I

Vector Algebra – gradient of a scalar field – divergence of a vector field– curl of a vector field – vector identities – Gauss's divergence theorem – Gauss's law in differential form – Poison and Laplace equation – Stoke's theorem – Green's theorem (using Gauss's divergence theorem) – Green's theorem for a plane – Helmholtz's theorem.

Unit – II: Vectors – II

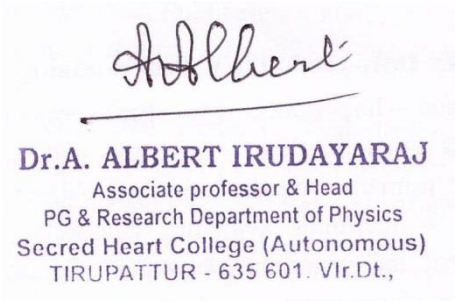
Orthogonal curvilinear coordinates – differential operators (gradient, divergence, Laplacian and curl in terms of orthogonal curvilinear coordinates – differential operators (gradient, divergence, Laplacian and curl in terms of spherical polar and cylindrical coordinates.

Unit – III: Dirac–Delta function and Green's function

Dirac–Delta function – representations of Dirac Delta function - Kronecker delta – properties of Delta function – Fourier transform delta function – Laplace transform delta function – derivative of delta function –Three dimensional delta function.

Green's function – Properties – Methods of solution in one dimension – symmetry property of Green's function – Eigen function expansionUnit–IV: Fourier series

Periodic functions – evaluation of Fourier coefficients – Dirichlet's conditions (statement only) – Orthogonality of sine and cosine functions – even and odd functions and their Fourier expansions – applications: half and full wave rectifier.



Unit – V: Applications of Partial Differential Equations in Physics

Laplace's equation – solution in Cartesian coordinates – two dimensional steady flow of heat–solution in two dimensional cylindrical coordinates (circular harmonics) – solution in spherical polar coordinates – variable linear flow of heat – two dimensional heat flow.

Books for study

P. Satya Prakash, Mathematical Physics, S. Chand & Company Ltd, New Delhi, 2004.

H. K. Dass, Mathematical Physics, Sultan Chand and company, New Delhi, 2013.

B. D. Gupta, Mathematical Physics, Vikas Publishing House (P) Ltd., U.P, 2006.

R. Murugeshan, Mechanics and Mathematical methods, S.Chand & Company Ltd, New Delhi, 2003.

P. K. Chattopadhyay, Mathematical Physics, New Age International (Pvt) Ltd., New Delhi, 2001.

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G. B. Arfken and J. Weber, Mathematical methods for physicists, Elsevier academic press, 2005.

E. Kreyszig, Advanced Engineering mathematics, Wiley India Pvt Ltd, New Delhi, 2015

K. F. Riley, H. P. Hobson and S. J. Bence, Mathematical methods for physics and Enginnering, Cambridge university press, USA, 2006.

Rajput, Mathematical Physics, Meerut, Pragati Prakashan Publishers, 1985.

Charlie Harper, Introduction to Mathematical Physics, Prentice–Hall Pvt. Ltd., New Delhi, 1993.

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http://hyperphysics.phy–astr.gsu.edu/hbase/vect.html

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en.wikipedia.org/wiki/Dirac_delta_function

http://tutorial.math.lamar.edu/Classes/DE/DiracDeltaFunction.aspx

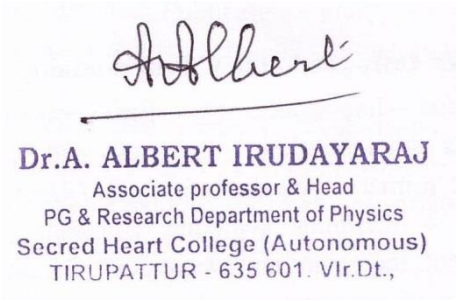
http://mathworld.wolfram.com/FourierSeries.html

en.wikipedia.org/wiki/Fourier_series

http://www.sosmath.com/fourier/fourier1/fourier1.html

http://nptel.ac.in/courses/111103021/

http://tutorial.math.lamar.edu/Classes/DE/IntroPDE.aspx



Subject Elective I: Crystal Growth and Nanoscience

Semester : V

Hours/Week : 3

Course Code :

Credits : 2

Objectives

To provide an introduction to the relationship between nucleation and growth.

To expose to the various theories of crystal growth.

To familiarize solution growth and gel growth techniques.

To introduce to the rapidly developing field of nanoscience and technology with special focus on the methods of synthesis, characterization techniques and applications of nanomaterials with interdisciplinary approach.

Learning outcomes

The students will gain knowledge of different crystal growth techniques and the theories behind them.

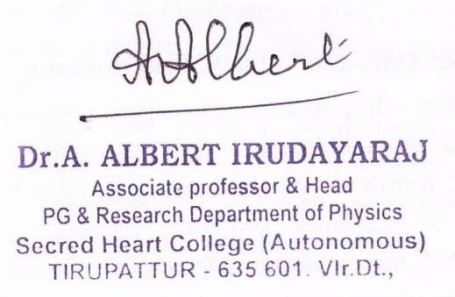
The students will get to know about Nanomaterials and different methods of synthesizing Nanomaterials.

Students will gain a knowledge of different methods of characterizing the crystal samples and Nanomaterials.

Unit – I: Theories of Crystal Growth

Supersaturation – basic steps in crystal growth – nucleation – types of nucleation – energy of formation of a nucleus – spherical nucleus – cylindrical nucleus – classical theory of nucleation: Gibbs Thompson equation for vapor – Gibbs Thomson equation for solution – crystal growth theories: surface energy theories – adsorption layer theories – kinetics of crystal growth – singular and rough surfaces – KSV theory – BCF theory – BCF theory of solution growth – periodic bond chain theory – Muller-Krumbhaar model – diffusion – reaction theories.

Unit – II: Solution Growth Low temperature solution growth – solubility and supersolubility – expression of supersaturation – solubility diagram – metastable zone width – pH and its control – different methods of low temperature solution growth: slow cooling method – slow evaporation method – temperature gradient method – crystal growth system: constant temperature bath – crystallizer – filtration assembly – seed, seed mount platform and



crystal revolution unit – factors influencing the perfection of the final crystal – control of crystal morphology – high temperature solution growth.

Unit – III: Gel Growth

Basic gel growth procedure – gel preparation and properties – gelling mechanism and structure of silica hydrogels – functions of the gel – ultimate crystal size – reimplantation – cusp formation – nucleation (general principles) – nucleation control – Liesegang rings – qualitative features of Liesegang rings.

Unit – IV: Introduction to Nanoscience

Basics about nano – emergency of nanotechnology – top-down and bottom-up approaches – quantum dots – quantum confinement – core shell structures – self assembly – hydrophilic and hydrophobic property – reverse micelle technique – self assembly – self cleaning materials – carbon nanotubes.

Unit – V: Synthesis of Nanomaterials

Chemical methods for the synthesis of nanoparticles and nanostructures – sonochemical method – solgel – forced hydrolysis – hydrothermal/solvothermal – advantages and disadvantages of chemical methods – template based method – physical methods for the synthesis – vacuum – rotary pump – diffusion pump – thermal evaporation – sputtering – Chemical Vapour Deposition (CVD) – Pulsed Laser Deposition (PLD) – advantages and disadvantages of physical methods.

Books for study

P. Santhana Raghavan, P. Ramasamy, Crystal growth Processes and methods, KRU Publications, Kumbakonam, 2000.

Heinz K. Henisch, Crystals in Gels and Liesegang Rings, Cambridge University Pres, Cambridge, 1988.

Skoog, Holler and Nieman, Principles of Instrumental analysis, Fifth edition, Harcourt Asia PTE Ltd., Singapore, 2001.

K. K. Chattopadhyay, A. N. Banerjee, Introduction to Nanoscience and Technology, New Delhi, PHI learning Pvt. Ltd., 2009.

Charles. P. Poole, Frank. J. Owens, Introduction to nanotechnology, New Jerssey, A John Wiley & Sons publications, 2003.

Books for reference

Govindhan Dhanaraj, Kullaiah Byrappa, Vishwanath Prasad, Springer Handbook of Crystal Growth, Springer, 2010.

William F Smith, Javad Hashemi, Foundations of Materials Science and Engineering, NewDelhi, Tata McGraw Hill, 2005.

A. W. Vere., Crystal Growth: Principles and Progress, Springer, 1987.

Ivan V. Markov, Crystal Growth for Beginners: Fundamentals of Nucleation, Crystal Growth and Epitaxy, World Scientific Publishing Company, 2003.

D. P.Woodruff, T. A. Delchar, Modern Techniques of Surface Science, Cambridge Solid State Science Series,1994.

D. Kealey, P. J. Haines, Analytical Chemistry, Viva Books Private Ltd, New Delhi, 2002.

Bernard Dennis Cullity, Stuart R Stock, Elements of X-ray diffraction, Prentice Hall, 2001.

Georg Muller, Jean–Jacques Metois, Peter Rudolph, Crystal Growth from Fundamentals to Technology, Elsevier, 2004.

Robert M. Silverstein, Francis X. Webster, Spectroscopic identification of Organic compounds, Sixth edition, John Wiley & Sons, New York, 1998.

Binay Kumar, R. P. Tandon, Advances in technologically important crystals, Macmillan, 2007.

Masuo Hosokawa, Kiyoshi Nogi, Makio Naito, Toyokazu Yokoyama, Nanoparticle Technology Handbook, Linacre House, Jordan Hill, 2007.

S. Shanmugam, Nanotechnology, Chennai, MJP Publishers, 2010.

A. K. Bandyopadhyay, Nanomaterials, New Delhi, New Age (P) Ltd., 2009.

T. Pradeep, Nano: The Essentials, New Delhi, Tata Mc Graw– Hill Publishers Company Ltd., 2007.

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http://filepost.com/files/7c371d78/Cryst

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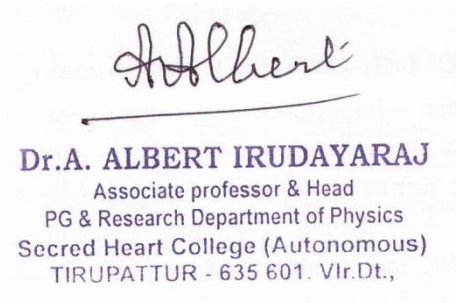
http://publib.boulder.ibm.com/tividd/td/ITIM/SC32–1708
00/en_US/HTML/im460_plan76.htm

http://en.wikipedia.org/wiki/Chemical_vapor_deposition

http://tss.asminternational.org/content/ASM/StoreFiles/ACFAA6E.pdf



Subject Elective I: Renewable Energy and Energy Harvesting

Semester : V Hours/week : 3

Course Code : Credits : 2

Objectives

To make the students to understand the importance of renewable energy and energy harvesting for future fulfillment of energy for mankind.

Learning Outcome

Students will acquire knowledge about the various alternative sources and its importance apart from the fossil fuels

Students will be able to construct and demonstrate working of energy conversion systems.

Students will implement the idea in energy harvesting, consumption and saving of energy in day today life.

Unit– I: Conventional and Alternate Sources of energy

Fossil fuels and its limitations – Nuclear Energy – Advantages and disadvantages – Need of renewable energy – Non-conventional energy sources an overview: Solar energy – Wind Energy – Tidal Energy – Ocean energy – Geothermal — Hydroelectricity.

Unit–II: Solar energy and its applications

Significance of Solar energy – solar energy collector – Types –Liquid Flat plate collector and concentrating collector – storage of solar energy – applications of solar energy – solar water heater – solar cooker Solar driers – solar pump.

Unit– III: Wind Energy and its applications

Wind mill – Power from the wind – site selection for the installation – Principle and operation of WECS – Types – advantages and disadvantages – Energy storage – Applications of wind energy.

Unit– IV: Other Energy Sources

Biomass – Types – conversion technologies – wet process – photosynthesis – Biogas – Biogas plant – Types – KVIC – Biogas from plant wastes – Geothermal Resources – Energy from the ocean –OTEC – energy from tides –basic principles – hydrogen energy.

Unit– V: Energy Harvesting and Distribution:

Energy storage systems – Mechanical – electrical – chemical – electromagnetic – thermal – biological – Carbon captured technologies – power consumption – Environmental issues – sustainability – energy action planning – energy costing – data and information analysis.

Books for study

S. P. Sukhatme, Solar Energy, Principles of thermal collection and storage, Tata Mc.Graw Hills, New York, 1996.

G. D. Rai, Non conventional sources of Energy, Khanna publishers, New Delhi, 1996.

Kothari, Renewable energy sources and Emerging technologies, Prentice Hall India Learning Private Limited; 2 edition, 2011.

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D. Yogi Gowswami, Principles of solar engineering, 3rd edition, CRC Press, 2015.

John Twidell and Tony weir, Renewable energy resources, 2005, 2 edition, Routledge.

Frank Kreith, D. Yogi Gowswami Energy conversion, CRC Press, 2007.

G.N.Tiwari, M. K. Ghoshal, Renewable energy sources: Basic Principles and Applications, Alpha Science International, 2005

D. Yogi Gowswami, Energy efficiency and renewable energy handbook, edition, CRC Press, 2015.

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www.conserve–energy–future.com/alternativeenergysources.php

www.altenergy.org/

www.nuclearpower.net

www.renewableenergyworld.com/wind–power/tech.html

www.otecnews.org

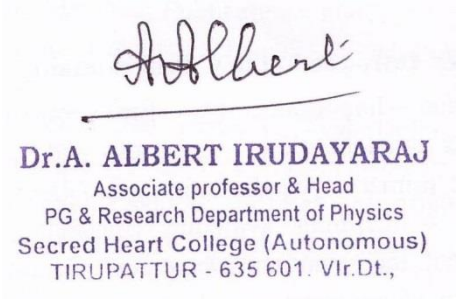
www.geothermal.org

www.wgbn.wisc.edu › Conversion

www.build–a–biogas–plant.com

www.energyharvesting.net/

www.utilitydive.com/



Subject Elective II: Applied Optics

Semester : V Hours/week : 3

Course Code : Credits : 2

Objectives

To impart the basic concepts of nonlinear optics and it applications.

To understand the principle of optoelectronics and their applications.

Learning outcome

Students can understand the behavior of materials in low and high intensity light.

Students will realize the construction and reconstruction of images in holography.

Students will understand the advance communication systems.

Unit – I: Non–Linear Optics

Nonlinear optical susceptibility – wave equations of nonlinear optical interactions – Sum frequency generation – Difference frequency generation – Second Harmonic generation – Phase matching condition – Optical parametric Oscillators – self focusing collapse – optical breakdown – two beam coupling – electro-optics and photorefractive effects – optically induced damage and multiphoton absorption.

Unit – II: Lasers and Optoelectronics

Quantum theory of atomic energy levels – radiative and nonradiative decay of excited state atoms – emission broadening and linewidth – radiation and thermal equilibrium – conditions for laser action – laser oscillation above threshold – laser amplifiers – requirements for obtaining population inversion – rate equations for three and four level systems – laser pumping requirements – laser cavity modes – Q-switching and mode locking – pulsed Nd:YAG laser.

Unit – III: Holography

Basic principle – theory – coherence, resolution – types of holograms: white light reflection hologram, polarization holography – application of holography in microscopy, interferometry, and character recognition.

Unit – IV: Detection of Optical radiations

Basic Principle and working: thermal detectors, photo multipliers, photoconductive detectors, CCDs, image Intensifiers.

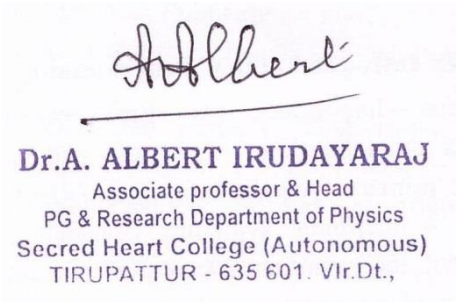
Optoelectronic modulators: basic principle and working of Birefringence - optical activity – electro optic modulator.

Unit – V: Advanced optical communication

Optical transmitter: basic concepts, characteristics of semiconductor injection LASER, LED, transmitter design.

Optical receiver: basic concepts, P-n and pin photo detectors, avalanche photo detectors, MSM photo detector.

Wavelength division multiplexing (WDM): multiplexing techniques, topologies and architectures, wavelength shifting and reverse, switching WDM demultiplexer, optical add/drop multiplexers.



Books for study

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P. C. Mehta, V. V. Rampal, Lasers and Holography, World Scientific Publishing Co. Ptv. Ltd., 1993.

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W.T. Silfvast, Laser Fundamentals, Second Edition, Cambridge University Press, 2004.

R . L. Sutherland, Handbook of Nonlinear Optics, Marcel Dekker, 1996.

O. Svelto, Principles of Lasers, Fourth edition, Springer, 1998.

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http://shodhganga.inflibnet.ac.in/bitstream/10603/41/8/chapter%205.pdf

http://www.optics.rochester.edu/research/nonlinear.html

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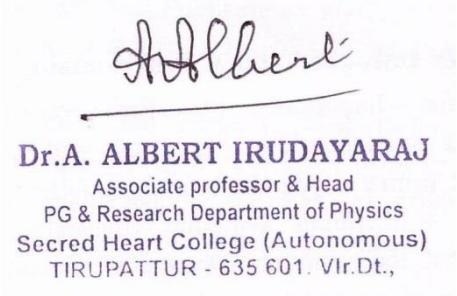


Subject Elective II: 8085 Microprocessor and its Applications

Semester : V Hours/week : 3

Course Code : Credits : 2

Objectives

To introduce the students to different number systems and to develop numerical skills.

To achieve general understanding of the fundamentals of microcomputers and microprocessor.

To familiarize students with instruction set and addressing modes of 8085 microprocessor.

To enable students to write assembly language programs and to know the interfacing applications.

Learning outcomes

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

Convert numbers from one number system to another

Define characteristics that distinguish 8085 microprocessor from others.

Identify different types of memory and describe how each is used.

To write assembly language programs for simple problems.

Unit – I: Number System and Fundamentals of Microcomputer

Number System: Binary – Decimal – Hexa decimal number system and their mutual conversions.

Microcomputer Organization – memory – types - semiconductor memory – types: RAM – ROM – PROM –EPROM – E2PROM – cache memory-tristate logic – buffer.

Unit-II: Architecture of 8085 and Interrupts

Microprocessor - evolution of microprocessors – applications of microprocessors - main features of 8085 – pin-out diagram of 8085 - architecture of intel 8085 microprocessor – bus – address bus – data bus – multiplexed address/data bus – demultiplexing address/data bus - control bus.

Interrupts of 8085: classification of interrupts – hardware and software interrupts – vectored and non-vectored interrupts – maskable and non-maskable interrupts.

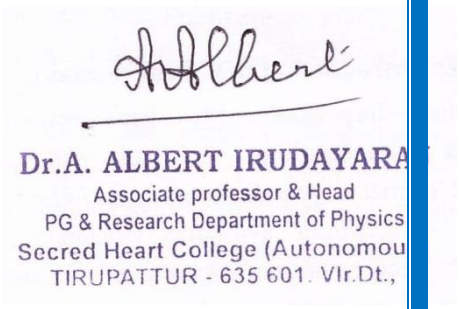
Unit-III: Instruction set

Instruction set: data transfer instructions- arithmetic instructions – logical Instructions – branch instructions – stack and stack related instructions-I/O instructions – subroutines.

Addressing modes: register addressing – immediate addressing – direct addressing – register indirect addressing – implied addressing.

Unit – IV: Timing diagram and delay routines

Timing sequences: instruction cycle – machine cycle – T-state – fetch cycle – execute cycle – op-code fetch cycle – memory read machine cycle – I/O read machine cycle – memory write machine cycle – I/O write machine cycle – time delay calculations.



Unit – V: Interfacing I/O Devices and Programming

Interfacing I/O devices: I/O Ports – memory mapped I/O – I/O mapped I/O –programmable peripheral interface intel 8255 – LED interface.

Programming: addition, subtraction, multiplication and division, ascending and descending order (8-bit).

Books for study

A. NagoorKani, Microprocessor and its Applications, Second Edition, Chennai, RBA Publications, 2006.

V.Vijayendran, Fundamentals of Microprocessor – 8085: Architecture, Programming and Interfacing, Chennai, S.Viswanathan (Printers & Publishers) Pvt. Ltd., 2009.

N. Senthilkumar, M. Saravanan, S. Jeevananthan, Microprocessors and Microcontrollers, Oxford University Press, 2010.

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Ramesh S. Gaonkar, Microprocessor Architecture, Programming and applications with the 8085, New Delhi, New Age International Publishers Ltd., 2006.

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Muhammad Ali Mazidi, Janice Gillispie Mazidi – The 8051Microcontroller and Embedded Systems, Pearson Education, Delhi, 2012.

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Subject Elective II: Medical Physics

Semester : V Hours/week : 3

Course Code : Credits : 2

Objectives

To explore the fundamentals of physics in the areas such as, Physiology, Radiation physics and medical imaging physics.

To provide an in–depth knowledge of radiation, its effects and radiation safety.

Learning outcomes

Students will be able to explain physics principles behind the various systems in a human body.

Students will able to explain and analyse the interaction processes of different types of radiations with matter, their roles in medical imaging, radiation therapy and medical imaging.

Unit – I: Physics of the body

Mechanics of the body: Skeleton – forces – body stability – muscles and dynamics of body movement.

Energy household of the body: Energy balance in the body – energy consumption of the body – heat losses of the body – thermal regulation.

Pressure system of body: Breathing – cardiovascular system – blood and circulatory system – blood pressure

Acoustics of the body: Nature and characteristics of sound – production of speech – Physics of the ear.

Optical and electrical system of the body: Physics of the eye – central and autonomic nervous system – electrical signals and information transfer.

Unit – II: Radiation physics, Accelerators and Detectors

Radiation exposure – absorbed dose – units: rad, rontgen – REM – gray – KERMA – CEMA – stopping power – relative biological effectiveness – effective dose – photon fluence and energy fluence.

Accelerators – types of accelerators – Pelletron –Thimble chamber – condenser chambers – GM counter – Scintillation counter

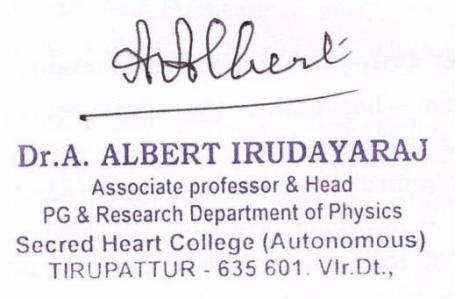
Unit – III: Diagnostic Systems

X-ray tube – rotating anode – tube rating – quality and intensity of X-ray – X-ray film – diagnostic applications of X-rays (Skeletal system and soft tissues) – mobile and dental X-ray machine.

CT scan – principle and working – Interaction of ultrasound with tissues (A Scan and B Scan) – Bio sensors applications (Diabetics, cardiovascular, cancer) – Radioactive tracers – Nanobio sensors.

Unit – IV: Bio Medical Imaging and Instrumentation

MRI – radiological imaging – Ultrasound imaging in Tomography – ECG (Electrocardiography) – EEG (Electroencephalography) – EMG (Electromyography) – ENG (Electroneurography) – cardiac pacemakers (Natural and Artificial) – AC and DC synchronized defibrillators – Endoscope.



Unit – V: Radiation hazards and protection

Radiation effects – radiation dose from natural radioactivity in the environment and manmade sources – effects of time and distance – radiation accidents emergencies in the use of radiation sources in medicine – biological effects of radiation (somatic, genetic stochastic and deterministic effect).

Radiation protection – shielding materials – permissible level of radiation – chemical protection – disposal of radioactive wastes safety rules and facilities – Dosimeter: TLD film badge, pocket dosimeter monitors – Radiation limits – Steps to reduce radiation to Patient, Staff and Public.

Books for study

J. P. Woodcock, Ultrasonic, Medical Physics Handbook series 1, Adam Hilger, Bristol, 2002

J.R. Cameron and J.G. Skofronick, Medical Physics, Wiley, 1978.

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K. Thayalan – Jayapee Brothers, Basic Radiological Physics Medical Publishing Pvt. Ltd., New Delhi, 2003

Curry, Dowdey, Murry, Christensen's Physics of Diagnostic Radiology, Lippincot Williams and Wilkins, 1990.

F M Khan – Williams and Wilkins, Physics of Radiation Therapy, Third edition, 2003.

Irving P. Herman, Physics of the human body, Springer, 2007.

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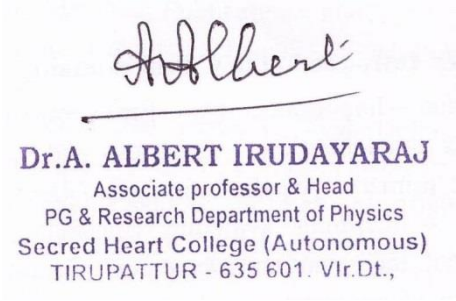

Self Study Paper: Astrophysics

Semester : V Hours/week : —

Course Code : Credits : 1*

Objectives

Providing a broad view of heavenly bodies.

Improving the understanding of solar system and the astronomical instruments.

Learning Outcomes

By the end of this course, the student will be able to

Gain a qualitative knowledge of the Universe and its content.

Demonstrate familiarity with the principal observational properties of stars and planets.

Explain stellar evolution, including red giants, supernovas, neutron stars, white dwarfs and black holes.

Describe the features of objects in the solar system: sun, planets, moons, asteroids, comets, planetary interiors, atmospheres, etc.

Unit – I: Cosmology and Galaxies

Origin of the universe – theories of Universe – structure of the universe – galaxy – types – galaxy collisions– clusters of galaxies.

Unit – II: Solar System

Origin – The Sun – physical characteristics– sources and transport of energy – solar atmosphere – Planets and Satellite of solar system – minor planets.

Unit – III: Stellar Evolution

Nebulae – types – Birth and Death of a star – supernovae explosion – binary stars – variable stars – white dwarfs – Chandrasekhar limit–neutron star – black holes.

Unit – IV: Magnitudes, Distance and Spectral Classification of Stars

Magnitude and brightness – apparent and absolute magnitude of stars – light year – geometrical parallax method – Harvard system of spectral classification – HD catalogue – HR diagram.

Unit – V: Astronomical instruments

Radio telescope – optical telescopes – refracting telescope – reflecting telescope: types, advantages – Hubble's space telescope – mounting of telescope – filar micrometer.

Books for study

K.S. Krishnaswamy, Astrophysics a modern perspective, New Age International (p) Ltd, New Delhi, 2002.

BaidyanathBasu, An Introduction to Astro Physics, Prentice – Hall of India Private limited, New Delhi, 2001.

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Non Major Elective –I : Repair and Maintenance of Household Appliances

Semester : V Hours/week : 2

Course Code : Credits : 1

Objectives

To expose the students to the principles and working of home appliances.

To train the students in Repairing and Maintenance of home appliances.

Learning Outcomes

At the end of the course the students will have

A knowledge of Importance of observing the safety precautions

The ability to test the continuity of electrical lines with multimeter

The ability to dismantle and reassemble an electric iron

The ability to install a ceiling fan and the regulator

The ability to check a fluorescent lamp chock, starter and install it

Unit – I Electricity and Electrical safety

Introduction to electricity

Electric charge – Voltage – current – resistance – resistor – capacitance – capacitor – inductor – Ohm's Law – power.

Electrical safety

Safety – Tools for electrical safety – circuit breakers – fuse – Precaution during maintenance of home appliances – safety rules.

Unit – II: Earthing, Crimping and Soldering

Earthing

Need for earthing – types of earthing – working of earthing – advantage of earthing,

Crimping and soldering

Crimping – crimping tool, how to use – RJ – 11 connector – telephone wire – UTP cable – crimping technique – precaution during crimping – soldering – soldering method, zero defect soldering – de-soldering.

Unit – III: Home Appliances – I

Principle and working: electric iron, water heater, kettle, fault finding – removal of faulty component in electric iron, water heater, kettle.

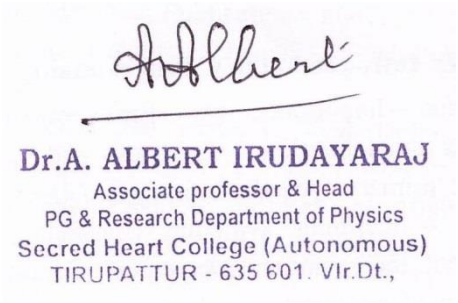
Unit – IV: Home Appliances – II

Principle and working: mixer grinder, wet grinder, ceiling and table fans – fault finding – removal of faulty component in mixer grinder, wet grinder, ceiling and table fans.

Unit – V: Lamps and Electrical Insulation

Lamps: Working principle of fluorescent, CFL and LED lamps.

Electrical Insulation: Need of electrical insulation – insulating materials – types of insulating materials.



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Eric Kleinert., Troubleshooting and Repairing Major Appliances., 3 rd Edition., McGraw–Hill Professional Publishing., 2012

C.S. Indulkar , S. Thiruvengadam , An Introduction to Electrical Engineering Materials., S. Chand., 2006

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Robert Rosenberg., Electric Motor Repair., Augie hand., 2011.

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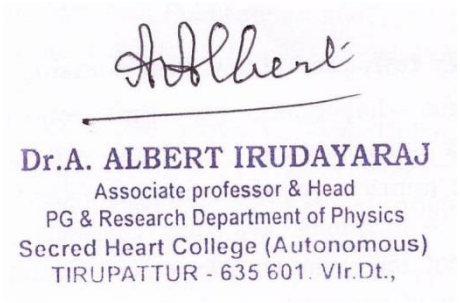


Quantum Mechanics and Relativity

Semester : VI Hours/ week : 4

Course Code : Credits : 4

Objectives

To make the students understand the basic concepts of Quantum Mechanics and fundamental postulates of Relativity

To enable the students acquire the problem solving ability and to apply the Schrödinger's wave equation for the situation of different physical problems.

Learning Outcomes

On completion of this course students will be able to

Understand the wave nature of matter and demonstrate an understanding of the nature of the quantum mechanical wave function and its basic properties.

Interpret the wave function and apply operators to it to obtain information about a particle's physical properties such as position, momentum and energy.

Understand the basic principles of quantum mechanics and operator formulation of quantum mechanics.

Explain the concepts of frame of reference and inertial frames and state the fundamental postulates of Special theory of relativity.

Unit – I: Matter waves and Uncertainty Principle

Wave – particle duality – matter waves – de-Broglie's wave length – wave packet –relation between phase velocity and group velocity – G.P Thomson's experiment – Davisson and Germer's experiment.

Heisenberg's uncertainty principle – Heisenberg's gamma ray microscope – diffraction of a beam of electrons by a slit – Applications: Non–Existence of electron inside the nucleus of an atom.

Unit – II: Schrodinger's formulation

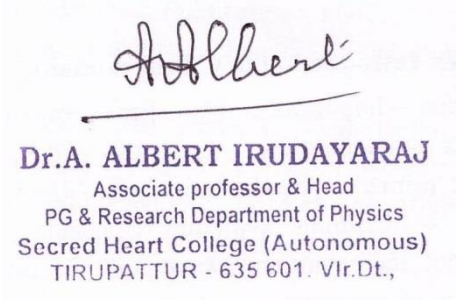
Postulates of quantum mechanics – linear, momentum and energy operators – Eigen functions and Eigen values – stationary states – expectation values – physical interpretation of the wave function – limitations on the wave function – probabilities and normalization condition – time independent Schrodinger's equation – time dependent Schrodinger's equation – Ehrenfest theorem – statement and proof.

Unit – III: Applications of Schrodinger's Equation

Particle in one dimensional box – one dimensional linear harmonic oscillator – quantum mechanical scattering and tunneling in one dimensional rectangular potential barrier – Scanning Tunneling Electron Microscope.

Unit – IV: Relativity Galilean Transformation equation

Frame of reference – inertial frames – non-inertial frames – fictitious forces – frame of reference and uniform motion – Galilean transformations – velocity, acceleration and force – invariance of acceleration and force under Galilean transformation – ether hypothesis – Michelson-Morley experiment – explanation of the negative results – special theory of relativity: postulates – Lorentz transformation – length contraction – time dilation – twin paradox – relativity of simultaneity.



Unit –V: Relativistic Mechanics and General Theory of Relativity

Relativistic addition of velocities –variation of mass with velocity – equivalence of mass and energy – evidences confirming mass – energy relation – energy– momentum of a particle with zero rest mass – Minkowski's space – space-time continuum – postulates of general theory of relativity – gravitational red shift – advance of the perihelion of mercury – deflection of light by the gravitational field.

Books for study

R. Murugeshan, Modern Physics, New Delhi, S. Chand & Co. Ltd, 2009.

SathyaPrakash, Advanced Quantum Mechanics, Meerut, Kendra Nath Ram Nath, 2009.

Albert Einstein, Relativity: The Special and the General Theory, General press, 2012

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V. Devanathan, Quantum Mechanics, New Delhi, Narosa Publishing House, 2005.

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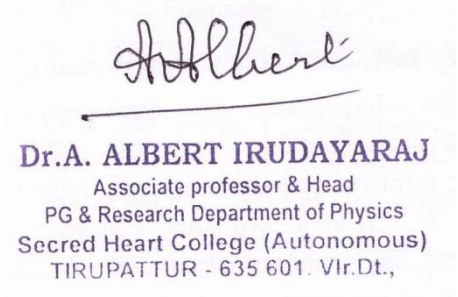


Subject Skill – I : Electrical Circuits and Networks

Semester : VI Hours/ Week : 3

Course Code : Credits : 3

Objectives

To develop a skill towards designing and trouble shooting of electrical circuits

To introduce them to the various circuit analysis theorems

To develop an understanding of single phase and three phase AC

To impart a knowledge of Transformers and Motors to the students

Learning Outcomes

On completion of this course, students will be able to

Locate, identify and rectify faults in simple electrical circuits

Use electrical instruments skillfully

Explain the effects of shorts and opens in series and parallel circuits

Analyse an electrical circuit with the help of circuit theorems

Unit – I: Basics of Electrical circuits

Voltage – Current (AC and DC) – Resistance – Electrical resistivity and conductivity – Ohm's law – Power – expression for power using Ohm's law – series and parallel circuits – voltage drop in series circuit – sign convention – circuit loads– combination of resistors, inductors and capacitors in series and parallel – Kirchoff's laws: current law and voltage law – applications of series and parallel circuits – electrical graphical symbols of common circuit elements

Unit – II: Electrical Circuit theorems (with DC circuits)

Network – branches – nodes – mesh current and node voltage analysis – voltage source and current source transformation – star and delta transformation – Thevenins theorem – Norton's theorem – superposition theorem – maximum power transfer theorem.

Unit – III: AC circuits

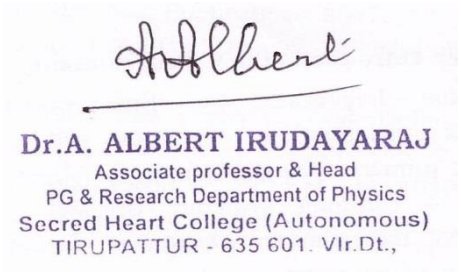
Single phase AC – instantaneous, peak, RMS and average values and form factor - concept of reactance, impedance, susceptance and admittance - phase and phase difference - concept of Power Factor.

Three phase AC – generation - importance of three phase circuits – star, delta connections –relation between voltages, currents of line and phase values in star and delta connections - live and neutral wire – domestic electric circuits –electrical appliances in parallel – current through appliances .

Unit – IV: Transformers and Electrical safety

Transformers – types – energy losses – methods of testing transformers – methods of cooling transformers – voltage control by tap changing – source of vibration and noise in transformers.

Short circuit – fuse – circuit breaker – earthing – reasons for earthing-system earthing-equipment earthing – safety in electrical work, accidents and treatment for electric shock, first aid.



Unit – V Electric Motors and Electrical Wiring

Electric Motors: Single-phase – three- phase – DC motors – Basic design – Interfacing DC or AC sources to control heaters and motors – speed and power of ac motor.

Electrical Wiring: types of conductors and cable – basics of wiring – Star and delta connection – Voltage drop – losses across cables and conductors – instruments to measure current, voltage, power in DC and AC circuits – insulation – solid and stranded cable – conduit – cable trays – splices: wirenuts, crimps, terminal blocks, split bolts, and solder – preparation of extension board.

Books for study

B. L. Theraja, R..S. Sedha, Principles of Electronic devices and circuits, S.Chand and company Limited, New Delhi, 2008.

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Subject Skill – II : Basic Instrumentation

Semester : VI Hours/week : 3

Course Code : Credits : 3

Learning Objective

To develop knowledge of principles and working of Analog and Digital Instruments used in the measurement of various physical quantities.

Learning Outcomes

On completion of the course, the students will be able to understand

The working principle of electrical and optical instruments used in the measurement of various physical quantities.

The measurements with a variety of instruments.

Unit -I: Electrical Instruments I

Construction and working: voltmeter, ammeter, wattmeter, galvanometer and ohmmeter - Working principle of potentiometer – analog multimeter – analog IC tester.

Unit - II: Electrical Instruments II

Principle and usage: AFO – VTVM – Q-meter – transistor tester – eliminator – dual power supply – transformers – vibrometers – tachometers – CRO.

Unit - III: Digital Instruments

Block diagram and working: digital voltmeter – digital multimeter – digital frequency counter – digital conductivity meter – digital pH meter – digital Balance.

Unit - IV: Optical Instruments

Principle and usage: compound microscope telescope: terrestrial and astronomical – binocular – spectrometer – direct vision spectroscope – spherometer – Michelson's interferometer– polarimeter – periscope.

Unit V: Environmental Instrumentation

Principle and usage: Hygrometers – anemometer – noise dosimeters – pyranometers and pyrheliometers – turbidity meter – pH meter – conductivity meter – thermometer – pyrometer – hydrometers – manometer – viscometer – barometer – lactometer

Books for study

Rajendra Prasad, Electronic Measurements and Instrumentation, Khanna Publications, Chennai, 2004.

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A. J. Bouwens, Digital instrumentation, New Delhi, McGraw Hill international, 1987.

Randy D. Down, Jay. H. lehr, Environmental Instrumentation and Analysis Handbook, 2004

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Self Study Paper : Physics Revisited

Semester : VI Hours/week : —

Course Code : Credits : 1*

Objectives

Enabling the students to revise the concepts of mechanics, oscillations, waves, Black body radiation, thermodynamics, statistical physics, Quantum numbers, semiconductor devices and their applications, this would help them to perform better in competitive examinations.

Learning outcomes

By the end of this course, the students should be able to

Recollect and explain the various physics concepts they have studied in their curriculum.

Unit - I: Mechanics, oscillations and waves

Laws of motion – work – kinetic and potential energy – friction – terminal velocity in air– conservation of linear momentum and angular momentum – moment of inertia – rotation about one axis – planetary motion and Kepler's laws – simple pendulum – simple harmonic motion – damped and forced oscillation– transverse and longitudinal waves – interference – beats – sound waves in air – Doppler effect.

Unit - II: Thermodynamic and Statistical Physics

Laws of thermodynamics – thermodynamic potentials– Maxwell relations– phase space – micro and macro states – ensembles– classical and quantum statistics – ideal Bose and Fermi gases – Black body radiation and Planck's distribution law.

Unit - III: Atomic and Nuclear Physics

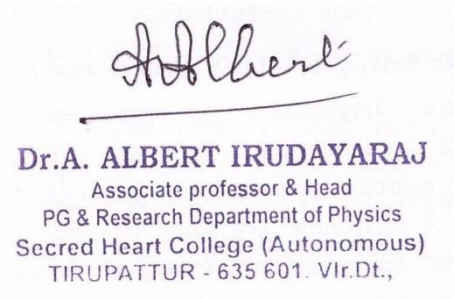
Quantum numbers – Pauli’s exclusion principle – electron spin – LS & JJ couplings – photo electric effect – X-ray – binding energy – semi-empirical mass formula – nuclear force – liquid drop model – shell model– alpha, beta and gamma decays – fission and fusion– Elementary particles.

Unit - IV: Quantum mechanics

Wave -particle duality – De Broglie concepts – Uncertainty principle – Schrödinger equation – Eigen value problems (particle in a box, harmonic oscillator, etc) – tunneling through a barrier – wave function in coordinate and momentum representations.

Unit - V: Electronics

Semiconductor devices (diodes, transistors, field effect devices) – optoelectronic devices (solar cells, photo–detectors, LEDs) – operational amplifiers and their applications – digital techniques and applications (registers, counters, comparators and similar circuits).



Books for study

R Murugeshan, Mechanics And Mathematical Physics, New Delhi, S.Chand Company, 2012.

Brij Lal, N. Subrahmanyam, P.S. Hemne, Heat Thermodynamics And Statistical Physics, New Delhi, S.Chand company, 2012.

R. Murugeshan, Modern Physics, New Delhi, S.Chand and Company Ltd., Ram Nagar, 2009.

D.C. Tayal, Nuclear Physics, Mumbai, Himalaya Publishing house,2011.

V.K. Mehta, Principles of Electronics, New Delhi, S. Chand & Co. Ltd., 2003.

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D Halliday, R. Resnick, J Walker, Fundamentals of Physics, Wiley New York 2001.

J. B. Rajam and C.L.Arora, Heat and Thermodynamics, New Delhi, S. Chand Company, 1984.

B. Basavaraj, A Text Book of Basic Electronics, Mumbai,Himalaya Publishing House, 2007.

G. Aruldhas, Quantum Mechanics, NewDelhi, Prentice Hall of India Pvt. Ltd.,2007.

S.P. Singh, M.K. Bagde, Kamal Singh, Quantum Mechanics, NewDelhi, S.Chand & company Ltd, 2000.

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http://physics.info/X-ray/

http://www.allaboutcircuits.com/textbook/semiconductors/chpt–5/junction–field–effect–transistors–jfet/

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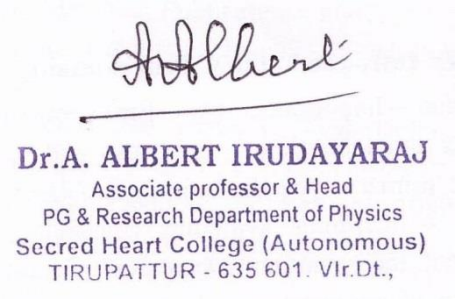


Non Major Elective: Physics in Everyday Life

Semester : VI Hours/week : 2

Course Code : Credits : 1

Objectives

To provide insights about how much of everyday life is governed by physics principles.

To create an interest towards science

Learning outcomes

On successful completion, the students will be able to

Demonstrate an understanding of how physics is applied to real life situations.

Unit-I: Mechanics

Laws of Motion – skating and falling balls-wind turbines and bumper cars- seesaws - dynamics of rotating objects – running – jumping – motion of spinning ball – Pressure – Applications: action of knife, dam construction – Physics behind soccer – Physics of rockets – flying balloons – air bag.

Unit - II: Light

Electromagnetic spectrum – Light – Sunlight – Rayleigh scattering - blue and red colours of sky – reflection: colours of objects – houses in hot countries painted white – dark uniforms in winter and light ones in summer – refraction and dispersion of light – rainbow – Doppler Effect – colours of stars.

Unit - III: Sound

Production of sound – Music and noise – propagation of sound in different media – echo - acoustics of buildings – audible limit – Ultrasound: use of ultrasound by bats – SONAR - depth of sea.

Unit - IV: Fluids

Fluids – density – Archimedes's principle – Applications: floating of ships, balloons – surface tension and viscosity – applications.

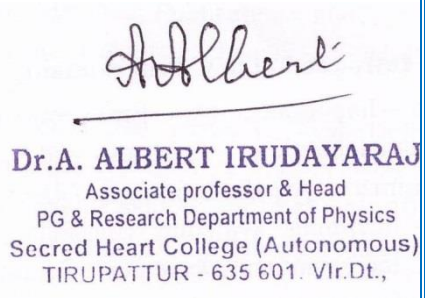
Unit - V: Electric devices

Electricity – current – voltage – heating effect of current: electric iron, electric heaters-induction stove – Electromagnetism: Faraday's laws – dynamo – motor – generator – transformers – Electric bells.

Books for study

Louis A. Bloomfield, How Things Work the physics of everyday life 5th Edition, The University of Virginia. 2013

Jay Newman, Physics of the Life Sciences, Springer Science+Business Media, 2008.



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J. B. S. Haldane, Science and everyday life, Vigyan prasar, 2002.

Stan Gibilisco, Alternative Energy Demystified, the McGraw-Hill Companies, 2007.

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www.ucsusa.org/clean-vehicles/electric-vehicles/how-do-hybrids-work#.WFN_3WgW0lQ

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http://savannah.nongnu.org/projects/fhsst